# Popular Science

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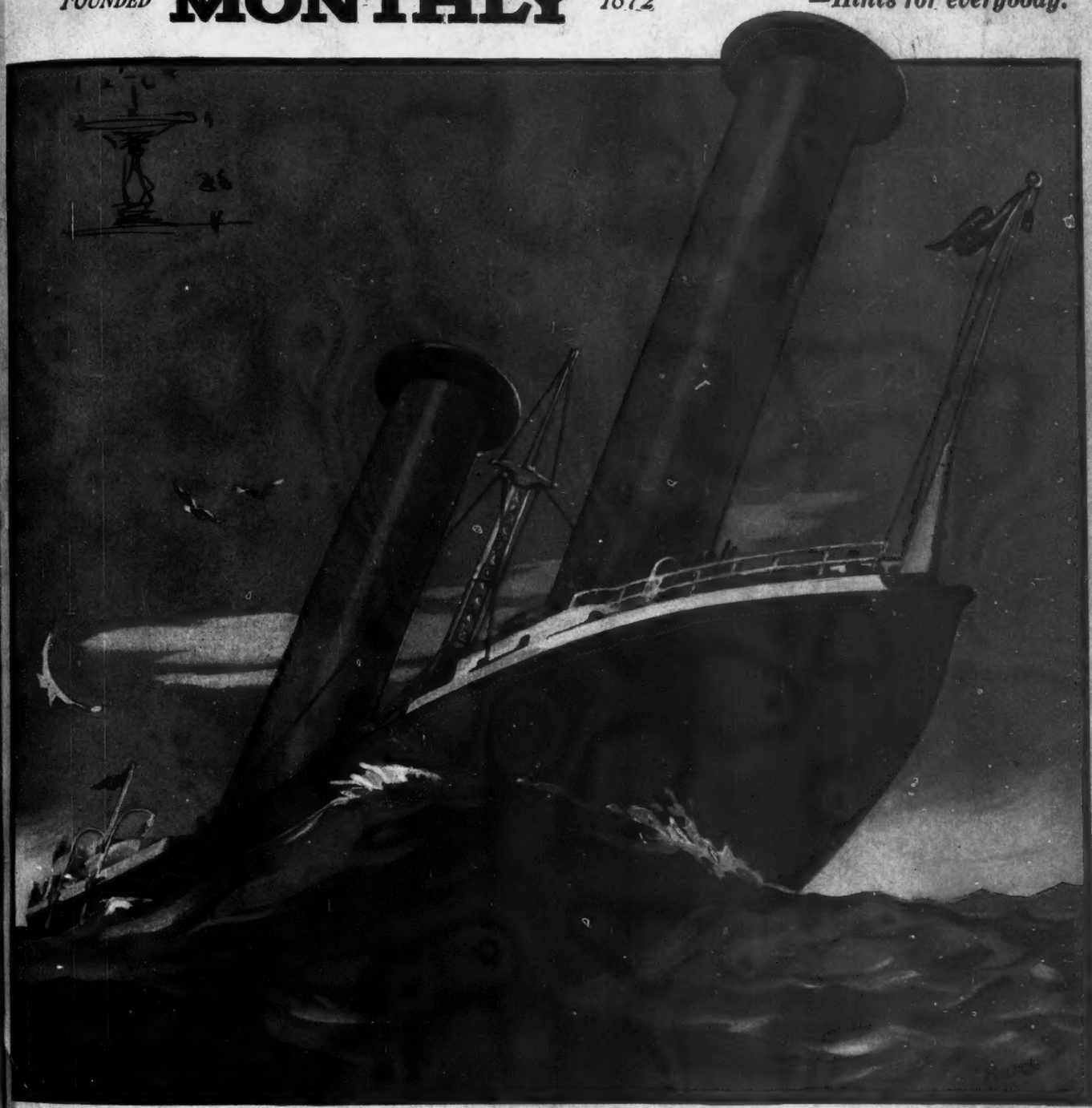
*RADIO SECTION*
*PAGE 82*

*How to build a 4-tube set to fit into your phonograph cabinet.*

*Jack Binns tells how to tune any receiver —Hints for everybody.*



## The newest wonder of the seas—p. 35

FEBRUARY — Henry Ford's amazing vision of the future — 25 CENTS

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POPULAR SCIENCE MONTHLY
SUMNER N. BLOSSOM, Editor
February, 1925

# A Sailing Ship without Sails; New Wonder of the Seas

## Huge spinning cylinders harness the wind—Inventor plans to take strange vessel across the ocean this year

*By G. B. Seybold*

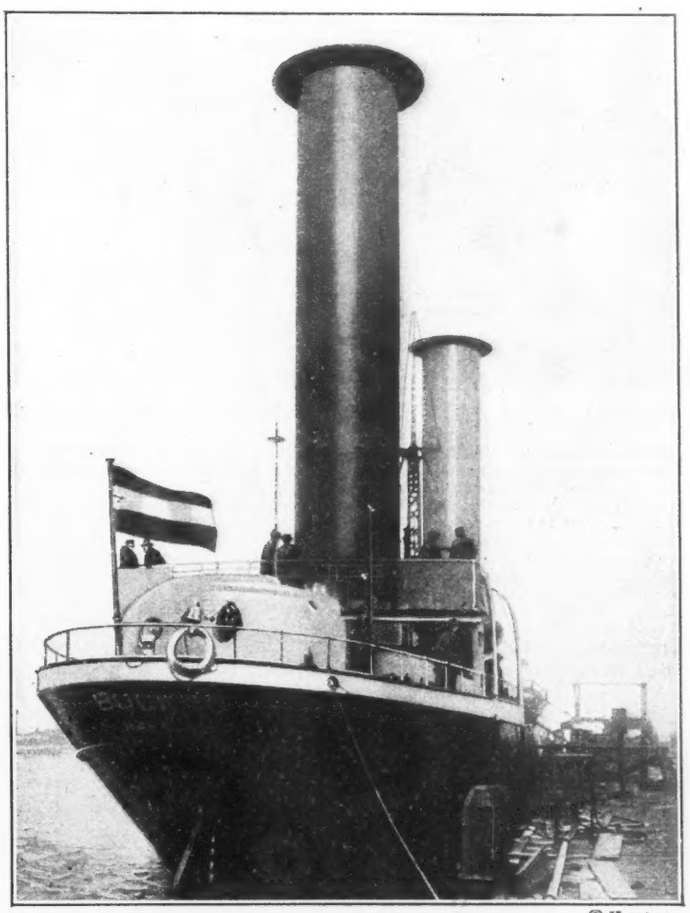
FROM the wharves at Kiel, Germany, the schooner *Buckau* recently put out to sea, a ship without sails or steam. Like a ghost ship it moved mysteriously through the water with no apparent means of propulsion.

The astounded spectators on shore knew that the boat was an old 2000-ton steel vessel and that previously 500 square yards of canvas had been needed to propel her. But now she was denuded of all sails, masts, and rigging. Instead, two strange cylinders, resembling giant smoke-stacks, rose from her deck. But no smoke was pouring from them and no engine noise was heard. There was no churning of screws. Yet the ship plowed its way through the rough waters of the Baltic, and at nearly twice its former speed.

FOR several weeks the secret of the strange ship with the great towers was closely guarded. People were told only that the craft was equipped with a Flettner rotor, a new invention, the work of Anton Flettner, director of the Institute of Aerodynamics at Amsterdam, Holland.

When finally the explanation came, the world gasped in amazement. For Doctor Flettner calmly announced that he had returned to the wind as a source of energy. He had harnessed it in a new way. He had developed an invention that may permit ocean liners to reduce their crews two-thirds and save 90 per cent in fuel. He had provided a way for one man to operate a ship, if need be.

The huge cylinders of the *Buckau*, he explained, were spun by a small engine, and these spinning surfaces, presented to the wind, provided a means of propulsion. This statement, after steamboats, oil-driven ships, and electrically operated ships had relegated sailing vessels into dim obscurity, immediately challenged international attention. Several authorities, including officials of a great steamship line, pronounced the invention the most startling maritime development since Fulton's steamboat. Others were more skeptical, asking how the *Buckau* would perform in a heavy sea, and are yet to be convinced of the value of the invention. They also pointed out that the most that can be claimed for the new ship is that it will apply to better advantage the power available for a ship supplied with sails. It cannot replace, in any case, the ship driven by steam or internal-combustion engines. In the United States most experts have adopted an attitude of "watchful waiting" with regard to the invention.



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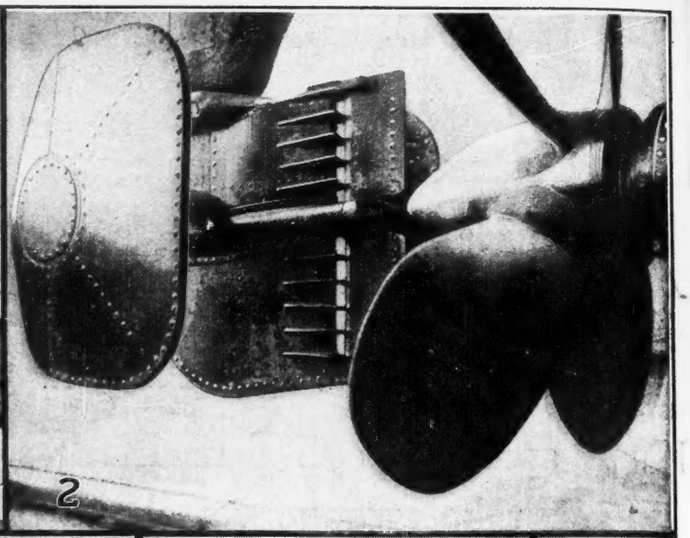
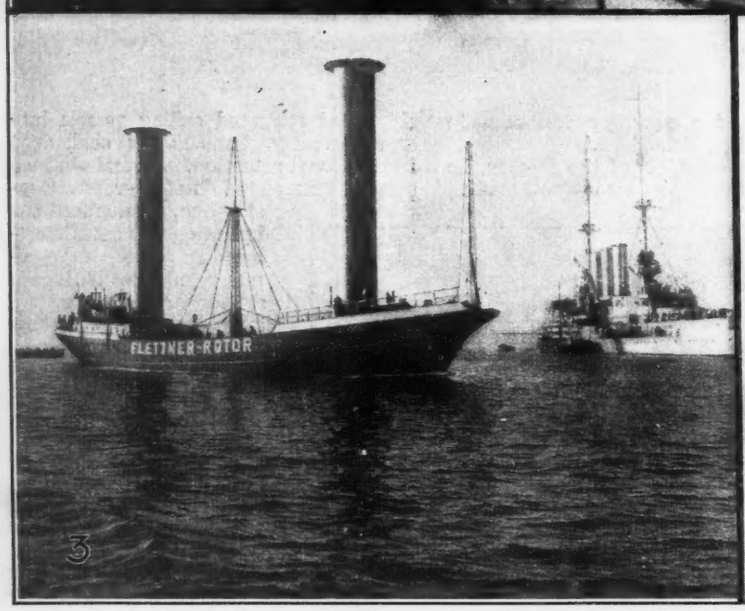
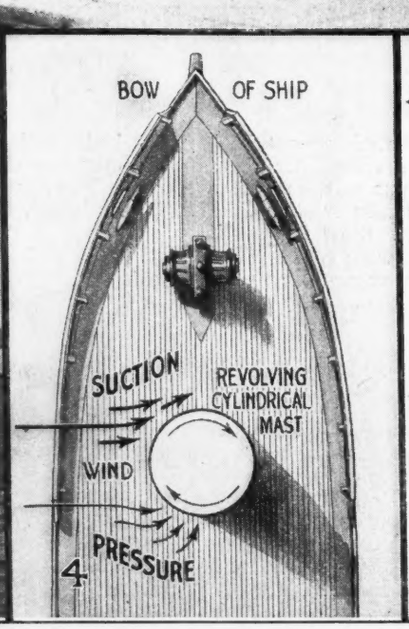
**The Amazing Sailless Rotor Ship at Its Wharf**

A recent stern-view photograph of the *Buckau* at Kiel, Germany. The inventor, Anton Flettner, declares that the two towering, spinning cylinders produce 15 times as much power as does an equal surface of canvas

THE scientific principle upon which Doctor Flettner based his invention has been known for nearly three-quarters of a century. Briefly, this is that a cylinder revolving in a current of wind will exert pressure at right angles to the current. This principle, known as the Magnus law, can be understood readily by any one who is familiar with baseball. The giant cylinders, or rotors, spinning in the wind, increase air pressure on one side and suction on the other, just as the surface of a rapidly spinning baseball from the hand of a pitcher piles up a difference of pressure on its two sides that deflects the ball into a "curve." In the case of the baseball, of





## A New Application of an Old Principle—the Rotor Ship and Its Inventor

**1—Anton Flettner (left), inventor of the sailless ship, with Captain Gerhards, commander of the *Buckau*, on the bridge of the vessel at Hamburg Harbor, Germany. 2—The rudder and auxiliary propeller of the *Buckau*. The three-bladed rudder is said to enable the ship to be turned around in its own length. 3—Side view of the ship. Each of the towering cylinders is 60 feet high and nine feet in diameter. 4—Diagrams showing operation of the revolving cylindrical masts, or rotors, in propelling the ship. The smooth surface of the cylinder, spinning in the wind, sets up increased air pressure on one side and suction on the other, driving the ship normally at right angles to the direction of the wind (see figure *A*). The lines in figure *B* indicate how air currents would be set up around the spinning cylinder, supposing there were no wind. Figure *C*, on the other hand, shows how the wind would pass around the cylinder, supposing it were not revolving. In neither case would there be any appreciable effect on the movement of the ship. But with the wind blowing and the cylinder spinning, the combined forces increase the pressure on one side and decrease it on the other, as in figure *D*, driving the ship forward in the direction indicated by the horizontal arrow within the shaded circle**

course, the equivalent of wind is produced by the swift passage of the ball from pitcher to catcher.

Each of the two spinning towers on the *Buckau* rests on a fixed pivot and moves on ball bearings. The towers are built of sheet iron about one-half an inch thick, are 60 feet high and nine feet in diameter. Two electric motors of 10 horsepower each, placed inside the pivots, drive the towers. Current for the motors is generated by a Diesel engine. The total weight of the complete mechanism—towers, engine, and motors—is about 15,000 pounds, just one-fifth the weight of the discarded sails and rigging on the same ship.

In propelling a sailing boat, suction, rather than pressure, Flettner explains, is the important factor in producing motive power. His aim was to produce artificially, by means of the revolving towers, a greater suction power than that produced on the vessel equipped with sails.

When wind strikes a sail, it divides equally, and in this division there results what is called a circular current. This works with the original current of wind on one side of the sail and against it on the other side. On the side where the current whirling around the sail is added to the original current, suction or pulling force is created, while on the other side the clashing of the two currents results in a pressure or pushing force. Of the two forces, suction is the greater factor in making the boat move forward.

The revolving cylinders on the sailless boat impel it on exactly the same principle as sails do, but more effectively, it is claimed, because a greater suction power is produced. As the wind hits one of the rotating towers from the side, one side of the cylindrical surface naturally is moving with the wind, and the other is going against it. There is very little friction on the side where the surface goes with the wind, and much friction on the other side.

The wind chooses the easier pathway, avoiding the side producing friction, and most of it goes in the direction in which the cylinder originally was traveling. Because the moving cylinder offers less resistance than a rigid sail, the wind, whirling around the cylinder, produces a much greater circular current than is created around a sail. Thus the suction is greatly increased, the inventor asserts, and the boat moves more swiftly than one with sails.

*(Continued on page 147)*

# *Henry Ford Says,* *as he turns out a car every twelve seconds:* "There Is Always Room for More"

## A surprising solution of traffic congestion as depicted by the maker of more than 10,000,000 automobiles—What Ford thinks about the future of "flivver" airplanes—How he directs the world's most amazing industry without an office

*By Raymond J. Brown*

A SHORT time after Dr. Hugo Eckener had piloted the ZR-3 (*Los Angeles*) across the Atlantic, and had seen it stowed safely away in its hangar at Lakehurst, N. J., he visited the plants of the Ford Motor Company near Detroit, Mich.

While he chatted with Henry Ford there, the conversation naturally enough veered around to aviation.

"I've never made a flight in an airplane," Mr. Ford said, "and I don't know that I'm particularly anxious to. I would, though, like to take a trip in a dirigible. Bring one out here some time, won't you, Doctor Eckener, and give me a ride?"

"I should be glad to, Mr. Ford," replied the other; "but it would be impossible to make a landing—you have no mooring-mast."

"That's right," nodded Mr. Ford reflectively; "we haven't." He turned instantly to one of his engineers who happened to be present. "You might get in touch with the Navy Department tomorrow," he suggested, "and get the specifications for a mooring-mast. We ought to have one here."

The mooring-mast is now being erected on the airplane landing-field near the Ford Experimental Laboratory at Dearborn.

I mention this incident because it illustrates aptly, I think, not only Henry Ford's characteristic way of doing things, but also a phase of his vast enterprises that probably is not clear in the popular mind.

THE building of that mooring-mast is not an expression of a sudden whim of Henry Ford. His wish to make a flight in a dirigible—probably uttered only half seriously—is only remotely connected with the erection of the mast, which is being put up because it has a definite, specific use to serve in the Ford organization. Dirigibles are driven by motors, and the production of motors and their development is the prime purpose of the Ford Motor Company.

In other words, Henry Ford is only incidentally a manufacturer of automobiles; his real business is the manufacture of *motors*. That the principal business of his company now is placing motors in automobiles is explained entirely by the fact that it is in automobiles that the motor finds its widest present-day use. Some day motors may be required in great numbers for other purposes. For that day the Ford organization even now is preparing.

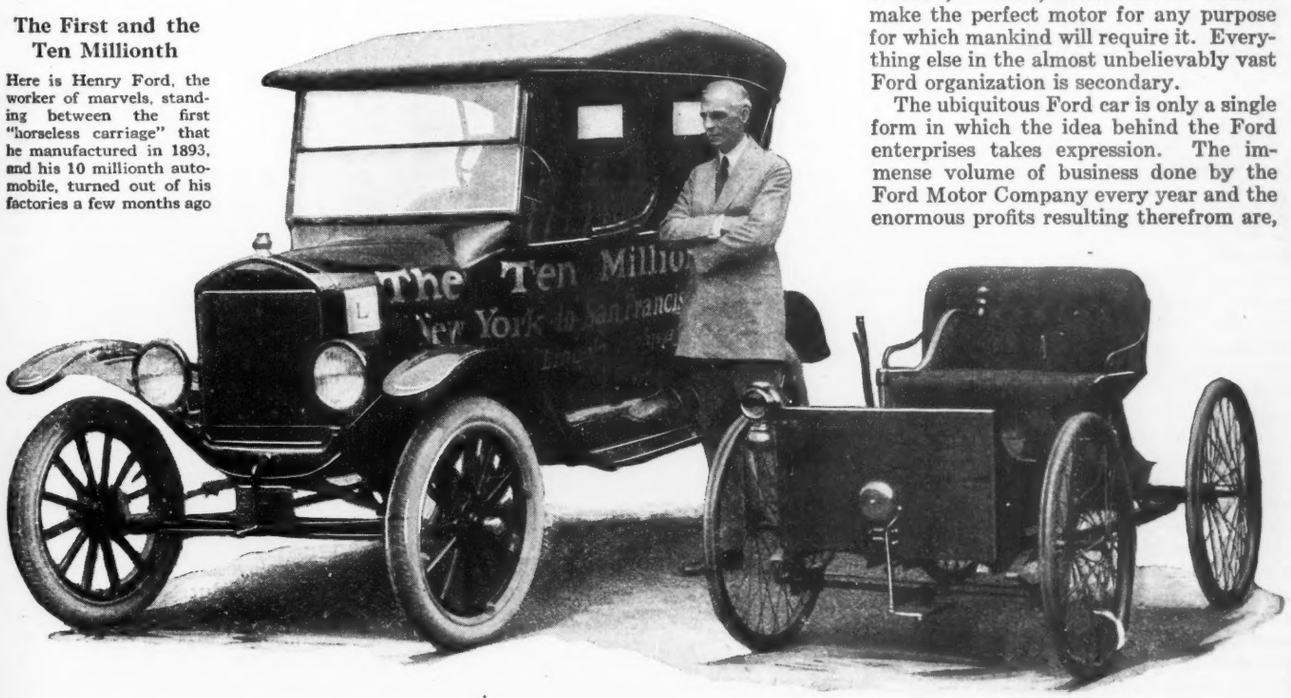
That is why a mooring-mast for dirigibles is being erected at Dearborn. That is why there is already an airplane landing-field there. That is why you'll find in the Ford Experimental Laboratory an all-metal speed boat, equipped with a 1000-horsepower motor, and like no other boat in the world. That is why, all about this boat, you will find automobiles, motors, and motor parts of many types and makes, constantly being studied and tested. That is why Henry Ford has placed on the Great Lakes two motor-driven freighters that are among the largest boats that ply the waters. That is why in the offices of the experimental laboratory—the closest thing to a headquarters that Henry Ford himself has—you will find virtually nothing that is not directly connected with motors—models of motors, plans of motors, sectional drawings of motors, maps showing the location of the Ford iron mines, the Ford coal mines, the Ford forests, whence are taken the raw materials from which are to be fashioned—motors.

THE Ford Motor Company has set out to know and understand what the motor will do under all circumstances, under every conceivable condition of use; to learn, in short, what must be done to make the perfect motor for any purpose for which mankind will require it. Everything else in the almost unbelievably vast Ford organization is secondary.

The ubiquitous Ford car is only a single form in which the idea behind the Ford enterprises takes expression. The immense volume of business done by the Ford Motor Company every year and the enormous profits resulting therefrom are,

**The First and the Ten Millionth**

Here is Henry Ford, the worker of marvels, standing between the first "horseless carriage" that he manufactured in 1893, and his 10 millionth automobile, turned out of his factories a few months ago



in a sense, only by-products of the effort that more than 150,000 Ford employees all over the world are making to perfect the motor. Henry Ford himself made that statement to me recently at Dearborn.

INTO that effort is poured a wealth of natural resources—mine products, forest products, farm products—a wealth of technical skill, and the accumulated results of the labor of many men in many diverse branches of science. These and the factories, railroad, and shipping lines, assembly plants and sales agencies, offices and laboratories, all the great enterprises that are necessary to the operation of the Ford Motor Company, Henry Ford has welded into an organization that stretches to the ends of the earth, and yet remains compact, mobile; a marvel and a miracle of efficiency.

Coal and iron from the Ford mines in Kentucky, West Virginia, and Michigan, and timber from the Ford forests on the upper Michigan peninsula, are rushed in Ford ships and over the Ford railroad (the D. T. & I.) literally to be hurled into the indescribably huge Ford plants about Detroit, where they are transformed with bewildering speed into finished motor-cars and tractors that move away under their own power, or into motor-car parts boxed for shipment to the assembly plants in this country and abroad.

It may give you a notion of the celerity with which things are accomplished in these Detroit plants when I say that 80 minutes after a cylinder-block casting from the Ford foundry at River Rouge—the world's largest, by the way, where 1900 tons of iron are poured a day—enters the world-famous "Ford factory" at Highland Park, it is in a freight car, a complete automobile power plant, tested and passed, ready to be made part of a chassis and driven away. As a stunt, for the entertainment of the Prince of Wales when he visited the Ford plants recently, a Ford car was completely assembled in 26 minutes!

Such things are made possible only by the magic of efficiency and organization, exemplified here in three ways:

First, each man—and there are about 100,000 who work in the Ford plants at Detroit—has one job to do and no more. It may be only inserting and tightening a single bolt in a cylinder head, or it may be giving the final inspection to a finished car. He does that one job, and no other; his neighbor's job is none of his concern, nor does he attempt to make it any.

Second, by an amazing and bewildering system of conveyors, each man's work is brought to him, remains with him just long enough for him to complete it, and then is carried on to the man who performs the next step in the manufacturing process. Some jobs, of course, take more time than others, but the movements of the conveyors synchronize perfectly with the movements of the worker, who is never hurried and never left idle; his work is always before him when he is ready for it, away from him when he has finished it.

The third phase of the system is the practice of completing each individual operation of manufacture in one place—making each Ford plant in effect a great number of little factories. Thus, if a part had to be cut to size, machined, painted, tipped with wood, covered with leather and crated for shipment, the various operations would not be performed in a central machine-shop, a central wood-working shop, and so on. The unit making the part would have its own machine-shop, its own paint-shop, its own boxing department. The time and labor saved by such methods, the waste and lost motion that they eliminate explain in large measure why every day there issues from the Highland Park plant in finished cars and parts the equivalent of 7000 automobiles—one every 12 seconds or so.

Probably a picture of the immensity of the results achieved by the Ford organization can be given in no better way than by a comparison. When, about six months ago, Henry Ford turned out his 10 millionth automobile, he had made available for the world a total of about 220,000,000 horsepower, or 76 times the potential power of Niagara Falls; 10 times the total hydroelectric power that has been developed throughout the world; almost 25 times the total available electric power of the United States!

And this he has done by means of a machine, which, pound for pound, is produced more cheaply than any other similar machine in the world. A Ford touring-car costs 20 cents a pound, finished, while a bicycle costs about a dollar, a locomotive something between 50 cents and a dollar.

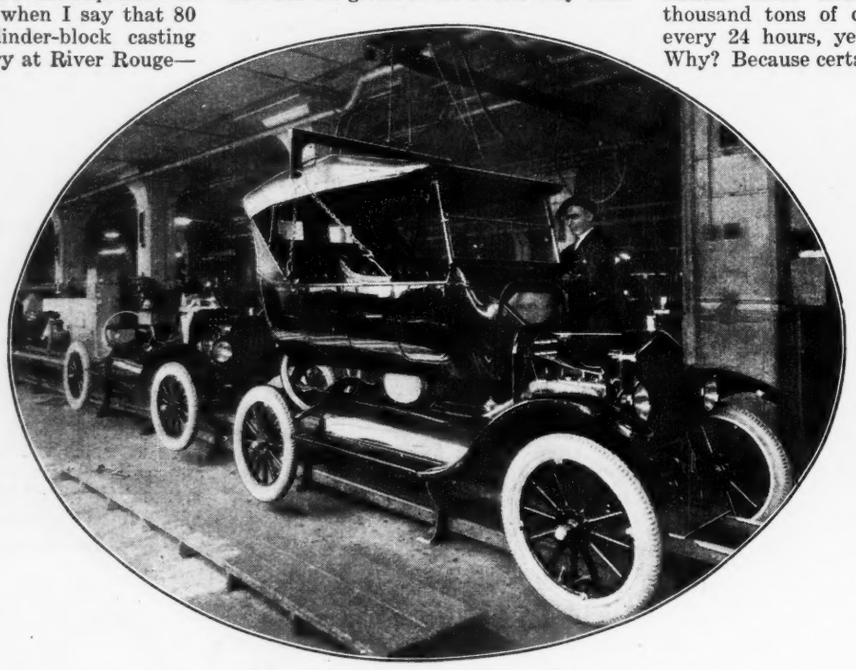
WHICH leads, naturally enough, to a consideration of another amazing phase of the Ford way of doing things. At least three times Henry Ford has made the price of Ford cars exactly the cost of producing them. And on this basis he has sold them *at a profit!* Impossible? Not at all, for the profit came, not through some clever scheme of financing, but through wider application of new discoveries of science to manufacturing methods.

Examples of the way applied science has contributed to the lowering of Ford manufacturing costs with consequent benefit to the consumer are to be seen in every corner of the Ford factories; nowhere, though, on such a gigantic scale as in the marvelous plant at River Rouge, Mich., where are taken the first steps in making the products of nature into moving, useful motors.

I am exaggerating only slightly, for example, when I say that from the towering chimneys of this huge unit in the Ford scheme there issues no smoke. Ten thousand tons of coal are burned here every 24 hours, yet there is no smoke. Why? Because certain constituents of the coal, which ordinarily are wasted in industrial furnaces and pour forth from the chimneys as smoke, here are transformed into a variety of useful products to be used at the plant or sold outside.

There are, for instance, 55,000 pounds of ammonium sulphate, a valuable fertilizer, produced here daily; 17,000 gallons of benzol, an efficient motor fuel; 22,000 gallons of tar, useful in road construction or for other purposes; 12,000,000 cubic feet of gas, of which 2,000,000 are sold to the City of Detroit; light oil also — all products derived from what is usually the waste of coal, and without harming the efficiency of the coal as fuel, for there remains carbon in the form of coke to be used in the blast furnaces and sold to employees that their domestic fuel bills may be reduced.

Carbon-monoxide gas, waste product of the blast furnaces, is piped to the power house, to be burned with the pulverized coal used there, with a consequent in-



**The Last Step in Making a Ford Car—Fitting the Body**

Each of the 100,000 men who work in the Ford plants at Detroit has just one definite job to do, whether it be tightening a bolt in a cylinder head or giving the final inspection to a completed car. By an amazing system of conveyors, each car passes from one man to the next in the process of manufacture, the movements of the conveyors synchronizing perfectly with the movements of the workers. For the entertainment of the Prince of Wales not long ago, a Ford car was completely assembled by this system in 26 minutes!

crease in the thermal efficiency of the latter. About 250 tons of coal are burned here every day to produce 60,000 kilowatts in electric power; and only from three to five wheelbarrows of ashes result!

The firing-room in this plant is as clean as the operating-room in a hospital, and the firemen and other operators dress in suits of spotless white and keep them so.

So, of course, the cement mill was kept clean thenceforth. Everything that Henry Ford wishes done is done in just that way in the Ford organization, for he is not merely the founder of the Ford Motor Company and its nominal head, but the actual, active director of all its varying activities, its mainspring, the source of virtually all the ideas, innovations, and spectacular accomplishments that have made the company remarkable since its inception.

In fact, the most amazing thing about the more than amazing Ford Motor Company undoubtedly is Henry Ford himself.

Here is a man, head of one of the vastest manufacturing enterprises ever launched, generally believed to be the richest man in the world; possibly the richest man of all time; yet he has no office—none that he occupies regularly, at any rate. When he requires a desk to work at, he goes to his experimental laboratory at Dearborn, one of the least pretentious of his plants, and sits down at any desk, any table, or any drafting-board that happens to be unoccupied. If there is no desk or table available, he is content to sit down where he can and use his knees for a desk. They tell me that he perched himself on a radiator recently while he chatted with the Prince of Wales.

He dictates and signs his letters and checks "on the fly," wherever they happen to be brought to him—against a brick wall, the hood of an automobile, or the stator of an electric generator, if any of these happen to supply the most convenient rest. Rarely does he issue an order *as an order*. He merely talks the thing over with one of his lieutenants in the calmest, most detached manner imaginable. Eventually the other grasps the idea in full detail; then it is put into effect, automatically almost. It may be a matter of manufacturing or merchandising policy that involves millions of dollars; that is his usual method of putting it into force.

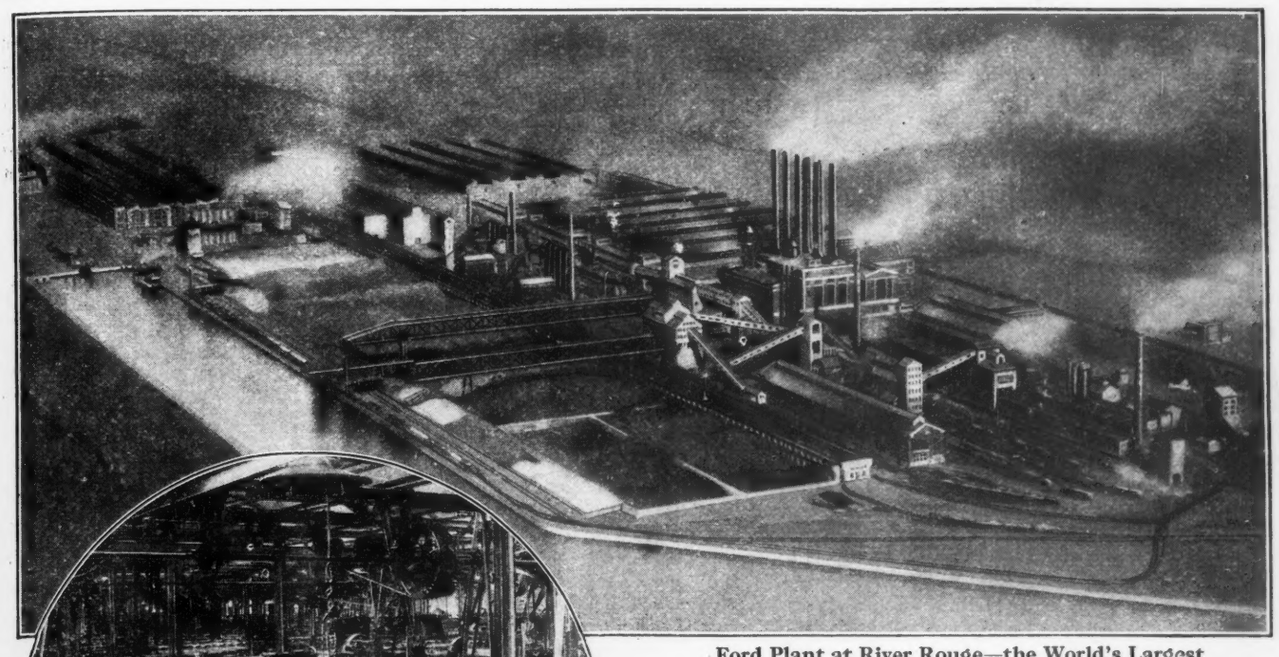
Perhaps it may strike you as anomalous that the man who is at the head of such a marvelous example of system and efficiency, where each man and each machine has only a single, definite task to perform, should himself apparently be so unsystematic that he does not even keep office hours.

AS TO that, let us see. In tying himself down to no settled routine, in appointing no definite place where he may be found at stated hours, Henry Ford is merely carrying out with regard to himself the same principles of efficiency that are in force in his factories. There, remember, each man has one job, and no more.

Henry Ford, too, has one job and no more—to manage, direct, and operate the Ford Motor Company. To accomplish his job he cannot remain in one place; he must "circulate." That is his own word; he has used it frequently in describing the functions of an executive.

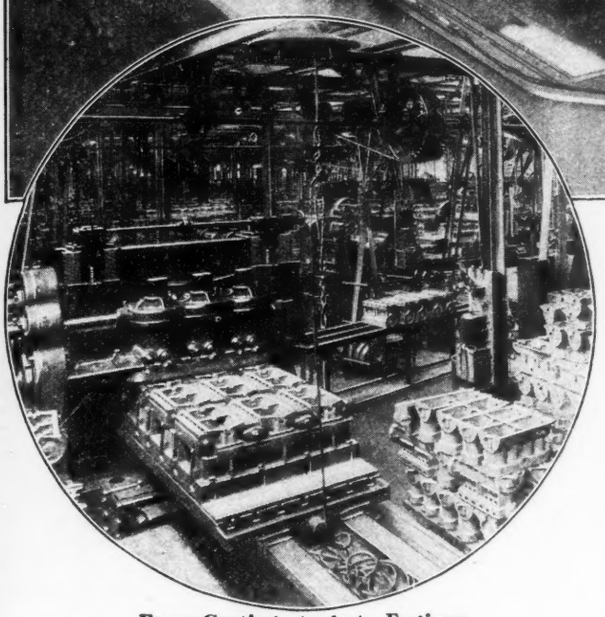
He does not believe that executives should have headquarters to which the men under them may bring their problems for solution. He believes rather that executives should move about among the men, where they can be on hand when a problem arises. Consequently, all executives in the Ford plants "circulate"—

(Continued on page 149)



**Ford Plant at River Rouge—the World's Largest**

In this vast plant, occupying 1100 acres, and containing 100 miles of railway track within its boundaries, the metal from the Ford mines is turned as if by magic into automobile parts. Here 1900 tons of metal are melted, molded and machined in a day. Here, too, all of the Ford tractors are manufactured. The equipment is sufficient to turn out 12,000 motor blocks a day. Projected expansions will give the electric power plant a capacity of 350,000 horsepower



**From Castings to Auto Engines**

Eighty minutes after a cylinder-block casting from the foundry at River Rouge enters the famous Ford factory at Highland Park, Detroit, it is converted into a complete power plant, tested and passed, ready to be made part of a chassis and driven away. This view in the Highland Park plant shows the machinery that handles castings. These must be exactly alike in order to fit any Ford car

THERE is a cement mill, too, where the slag from the iron ore—wasted ordinarily—is utilized in the manufacture of 3500 barrels of cement a day. If you know of the dust and dirt that usually accompany the manufacture of cement, you will be astonished at this mill, for everything about it is as clean, almost, as the firing-room just spoken of.

There was a time when it was not, however. That was when the mill was new—before Henry Ford had seen it in operation. After his first inspection, though, he did something that was quite unusual for him—he issued the following peremptory order:

"If that cement mill can't be kept clean," he said in effect, "close it up!"

How a telephone subscriber hears a message received in his absence by the automatic recording machine. A cylinder record takes the message of the caller, after another record has informed him the subscriber is absent

# This Automatic Secretary Talks to Callers

## Amazing New Office Machine Interviews Callers and Answers Phone Calls

**By Truman Stevens**

A RECENTLY invented machine performs in a way that is positively uncanny a variety of tasks ordinarily accomplished only by human hands and brains.

It will take dictation like a stenographer. It will serve as secretary of a meeting or office conference. It will answer the telephone in the absence of the subscriber, report his absence to the caller, and take a message that it will repeat to the subscriber on his return. It will record perfectly a telephone conversation from both ends, no matter how far separated.

It can be used as a dictograph in criminal or other investigations. It can be hooked up to a radio receiver so that it will record automatically stock-market quotations or similar broadcast messages at the proper time. It can be put to any or all of these uses, or to any others that the ingenuity or necessity of the user may warrant, without change of mechanism.

In appearance this amazing apparatus resembles somewhat an old-time phonograph, employing cylindrical records, or the ordinary dictating machine to be found in many offices. Like both of these devices, the new machine records conversations on a wax cylindrical record. Unlike them, however, the recording is accomplished not mechanically, but electrically, the sound vibrations of the voice being transformed into electrical currents in a sort of miniature radio transmitter, containing a vacuum tube and a complicated series of inductances.

These messages then are imprinted on the record, and are reproduced for the hearer by the usual phonographic process. Through the electrical system of recording an excellent quality of reproduction is attained, the listener hearing the true inflection and tones of the speaker's voice. Also it permits the use of a supersensitive microphone, which enables the user to give dictation in an ordinary conversational tone from 20 feet or more away, and also causes the machine, when it is used for that purpose, to record every word of a conversation in which several persons are taking part, no matter in what parts of a room they are situated.

By means of auxiliary apparatus a magazine of records may be installed in the machine so that when the end of one is reached, the next automatically starts recording, thus permitting dictation to be given or conversation of any sort to be recorded indefinitely. Each record may be shaved about 80 times before it becomes too thin to be used further.

The device may be operated for any of its many uses by either electric-lighting current or by a storage battery or dry cells, like a radio set.

WHEN the device is employed as a telephone operator, a message suitable for transmission to telephone callers during the absence of the subscriber is imprinted on a small auxiliary record at the left of the large wax cylinder. When a caller obtains the subscriber's number, in the absence of the latter, this little record is set in motion by the current operating the telephone bell, and the caller hears something to the following effect:

"This is the office of Smith & Co. There is no one here at present, but you may leave a message, or you may call again at 2.30 if you prefer."

Immediately after the delivery of this message, the machine is ready to record any message the caller may desire to give.

Used as the recorder of a telephone conversation, the machine starts working automatically the instant the call is put through, and imprints on the record every word uttered by either party. Brokers and others to whom repudiation of a telephoned order by a customer might mean a large financial loss, would find permanent records of their conversations of especial value.

## WHY I READ POPULAR SCIENCE MONTHLY

*A Prize Contest Announcement*

"UNTIL I found POPULAR SCIENCE MONTHLY, I rarely knew what to do with my evenings," a reader recently wrote. "I was just plain bored.

"But now, with a pipe, a pair of slippers, and POPULAR SCIENCE, I have 30 evenings of freedom from monotony at my command every month. Your magazine interests me, inspires me, and gives me a lot of valuable information. It arouses my curiosity and keeps my spirit adventurous, bucks me up when I am blue, and gives me the urge to do new and unusual things. I couldn't get along without reading it."

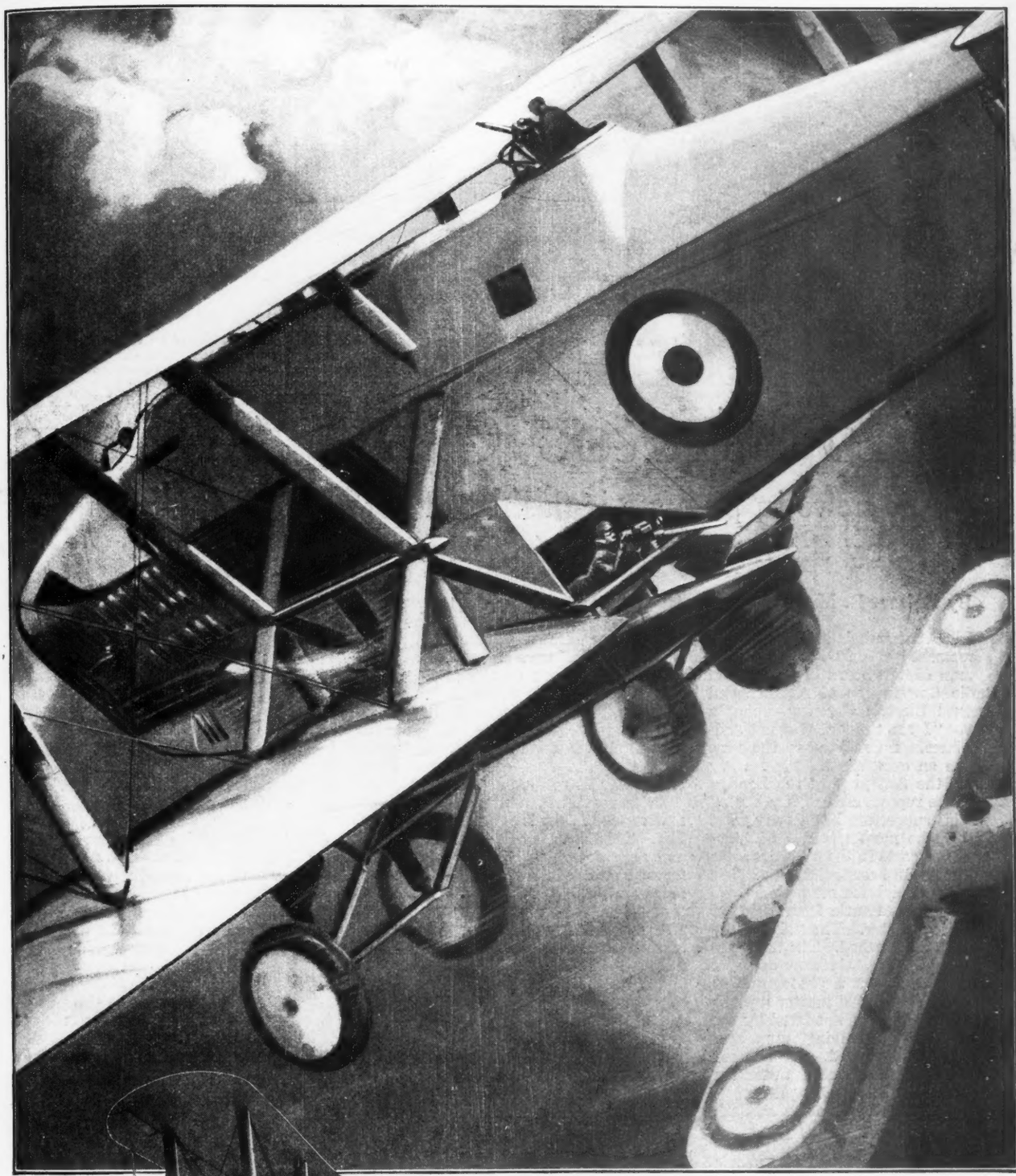
Thousands of such enthusiastic tributes have been received by POPULAR SCIENCE MONTHLY from its readers. Few, however, have condensed their appreciation into such a short letter. Why don't you try it?

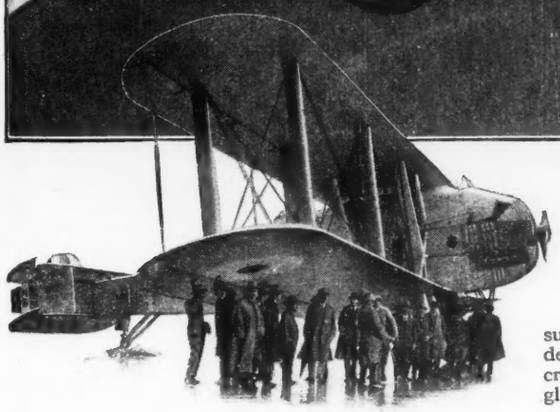
What do you like most about the magazine? What features hit you hardest? Why do you like them? How has the magazine helped you? Point out, if you wish, specific short-cuts and ideas in this or in any other number you have made use of. You may base your letter upon the contents of this issue or on the many numbers you have read and remembered.

For the best letter of not more than 250 words, we offer the following prizes: $10, first prize; $5, second prize, and $1 each for the 10 next best letters. Competition closes March 10. Announcement of the prize-winners will appear in the June issue. A Board of Editors will be judges of the contest.

Contributions to this contest cannot be returned unless accompanied by a self-addressed, stamped envelope.

Address The Editor, POPULAR SCIENCE MONTHLY, 250 Fourth Avenue, New York City.





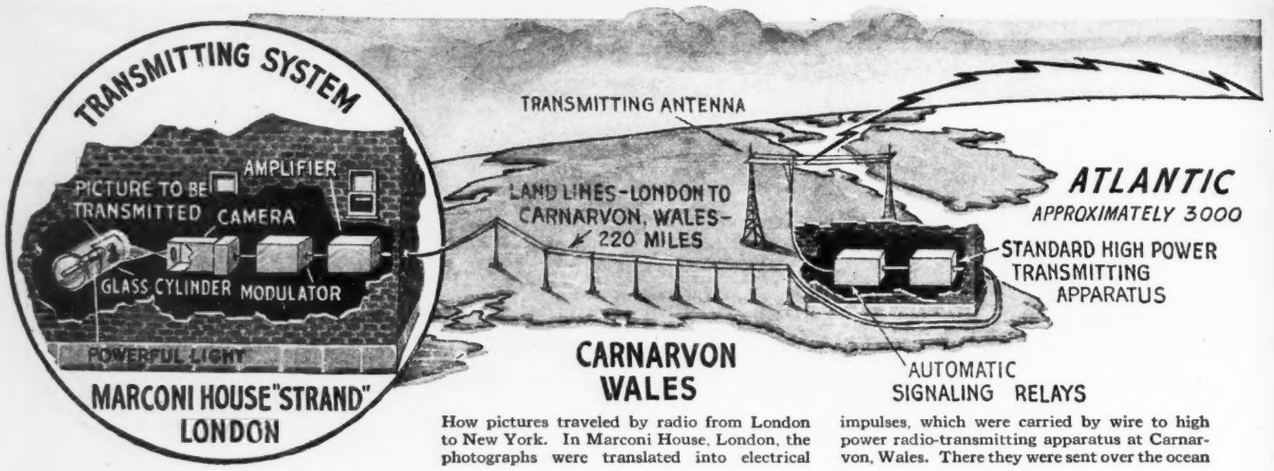
# Sky Superdreadnaught to Guard England

WHILE America's new sky leviathans, the *Los Angeles* and the *Shenandoah*, have been amazing the world with their successful performances, England has been testing out its first winged superdreadnaught of the air—a deadly new coast-defense aircraft, said to be the largest single-engined airplane in the world.

This mammoth machine, known as the "Cubaroo" Blackburn-Napier, recently completed a successful test flight near Hull, England. Driven by a huge 16-cylinder Napier motor of 1000 horsepower, it can carry and launch from the air at a battleship a full-sized naval torpedo weighing 1000 pounds. Its armament also includes great armor-piercing bombs, as well as machine guns for repelling air attacks.

Our artist has pictured above how this tremendous fighting machine might appear in action. The small photograph shows its vast size compared with a group of men who have found shelter beneath its enormous wing.

The plane is 54 feet long, 20 feet high, and its wing span is 88 feet.




How pictures traveled by radio from London to New York. In Marconi House, London, the photographs were translated into electrical impulses, which were carried by wire to high power radio-transmitting apparatus at Carnarvon, Wales. There they were sent over the ocean

# Radio Photos Cross the Sea

## The news in pictures is flashed over thousands of miles by the latest marvel of wireless communication

**By Robert E. Martin**

"RADIO transmission is too slow," remarked Owen D. Young, chairman of the board of directors of the Radio Corporation of America and the General Electric Company about a year ago. "I am tired of this dot-and-dash business. I want to see the time come when an operator will press a key and—zip! the first page of the London *Times* will be reproduced in New York."

From this suggestion has sprung what is probably the most amazing development that has come in the radio art since the beginning of broadcasting—wireless transmission of pictures more than 3000 miles across the Atlantic from England to the United States. The "zip" stage has not yet been reached. The first page of a newspaper cannot be sent over the ocean in a flash. But a photograph or other picture, or printed matter not too large in size to be accommodated by the transmitting and receiving apparatus that has been developed, can be sent across the ocean in about 20 minutes, the time it takes in ordinary radio practice to transmit 600 words by the dot-and-dash method.

RADIO Corporation engineers, headed by Capt. Richard H. Ranger, are responsible for this new wonder in radio, which in time may revolutionize the present system of transmitting messages.

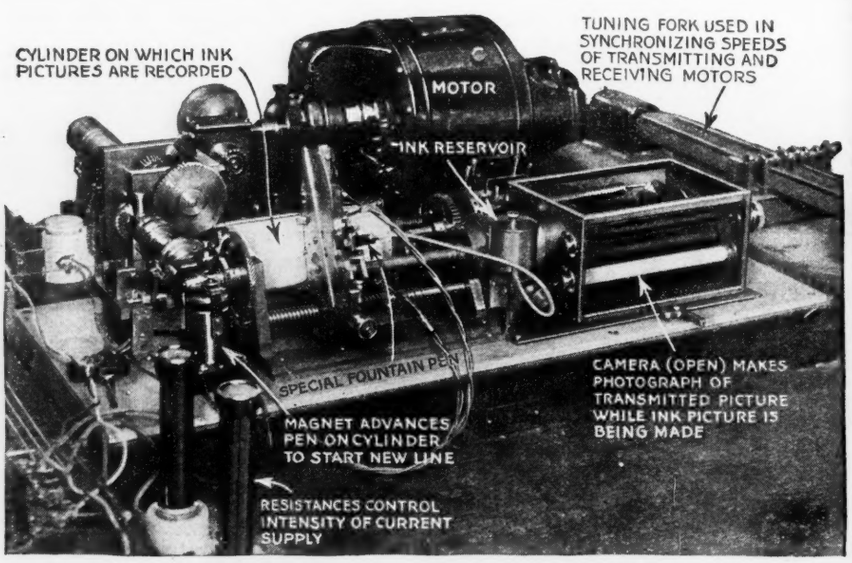
In one important particular, at least, the engineers who designed the radio picture transmitting and receiving apparatus have departed from the methods used in the past to transmit pictures through a distance. Where most previous successful systems have printed the received pictures only by means of light rays, in the new method of reception, not only is each picture reproduced photographically, but an additional picture is inked in simultaneously by an electrically controlled fountain pen that moves in wavy lines in accordance with the electrical impulses received from the transmitting station.

These pen-drawn pictures, which are made visibly, were intended at first merely as a check on the photographic reception process, which takes place within a special camera. It happened, though, that the pen-and-ink pictures presented such an odd and pleasing effect that the engineers concentrated their efforts on this method of reproduction.

In transmission, a photograph of the matter to be sent is made on a positive film. This is placed on a glass cylinder, and an exceedingly thin ray of light is focused on the film from within. This beam travels across the film in the direction of the length of the cylinder, and after each journey of the ray, the cylinder is revolved a minute distance. Eventually the whole film is traversed by the light.

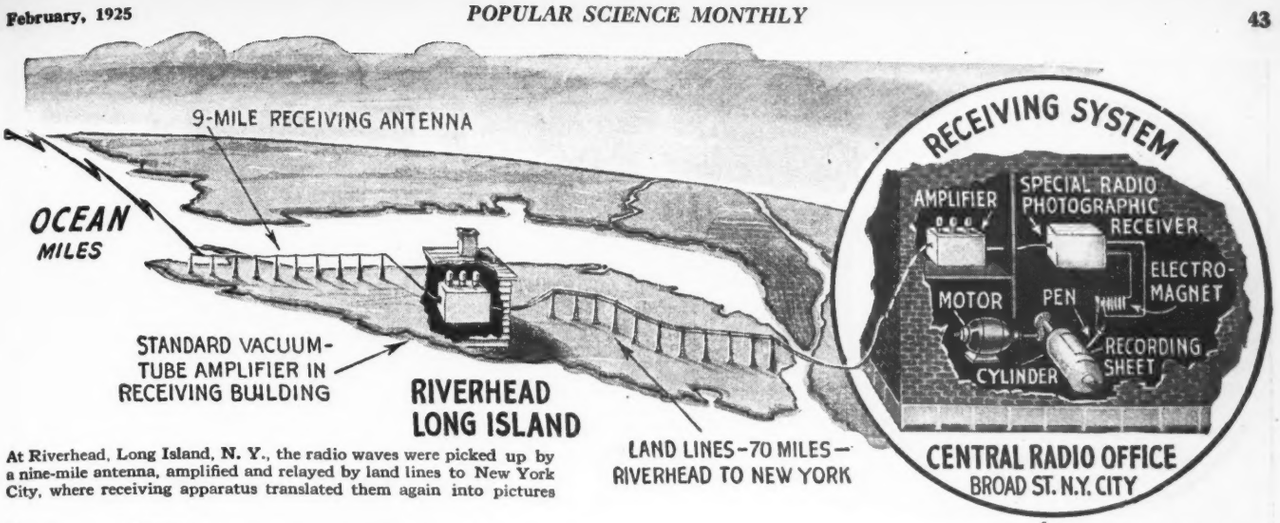
As the ray issues from the film, it passes into a photo-electric cell. The intensity of the ray, of course, varies as it penetrates dark or light portions of the film, and these variations produce corresponding variations in the electrical impulses that issue from the photo-electric cell. Thus light waves are transformed into electrical waves, which, amplified by vacuum tubes, may be transmitted by radio.

AT THE receiving end these electrical impulses are led through an amplifying device to the reproducing apparatus pictured on these pages. The amplified radio waves there operate an electrically controlled lever connected with a fountain pen. Each pulse of current causes


CYLINDER ON WHICH INK PICTURES ARE RECORDED
TUNING FORK USED IN SYNCHRONIZING SPEEDS OF TRANSMITTING AND RECEIVING MOTORS
MOTOR
INK RESERVOIR
SPECIAL FOUNTAIN PEN
CAMERA (OPEN) MAKES PHOTOGRAPH OF TRANSMITTED PICTURE WHILE INK PICTURE IS BEING MADE
MAGNET ADVANCES PEN ON CYLINDER TO START NEW LINE
RESISTANCES CONTROL INTENSITY OF CURRENT SUPPLY

**The Machine that Turns Radio Waves into Pictures**

Here is the remarkable receiving apparatus that translates radio-photograph signals simultaneously into photographic negatives and pen-and-ink reproductions of the original transmitted pictures. Its perfection makes it possible to flash pictorial news across the ether




At Riverhead, Long Island, N. Y., the radio waves were picked up by a nine-mile antenna, amplified and relayed by land lines to New York City, where receiving apparatus translated them again into pictures

the pen to leave a mark on the surface of a paper wound about a cylinder that is the same size as, and revolves synchronously with, the cylinder at the transmitting end.

SINCE the movements of the pen correspond with the original light waves that passed through the transmitting film, the received picture is virtually an exact duplication of that which is being transmitted. It is not an exact duplicate, for the reason that the pen tracing the received picture moves in wavy lines. These are caused by a transmission method that Captain Ranger devised. Instead of transmitting continuously, he has included in the sending apparatus a sort of trap where the electrical impulses are stored up until they reach a certain strength, at which they automatically become short-circuited and discharge. The result is that the recording pen moves not in a continuous line, but in a series of "dots" and "dashes." The wavy effect produced thereby is rather attractive and unusual.

Photograph of President Coolidge sent by wire from Cleveland, Ohio, to New York

The Same Photograph as it was received in New York by wireless from London

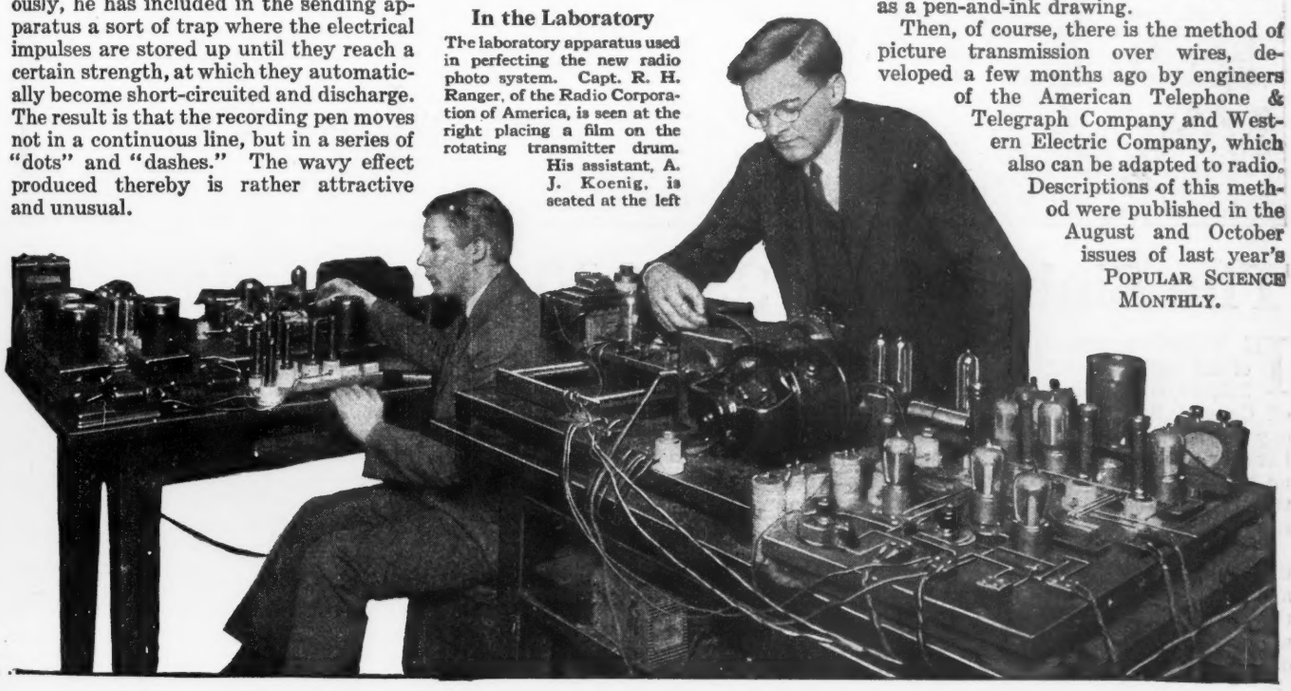
While these line reproductions are being formed, a camera installed in the receiving apparatus makes a photograph of the transmitted picture.

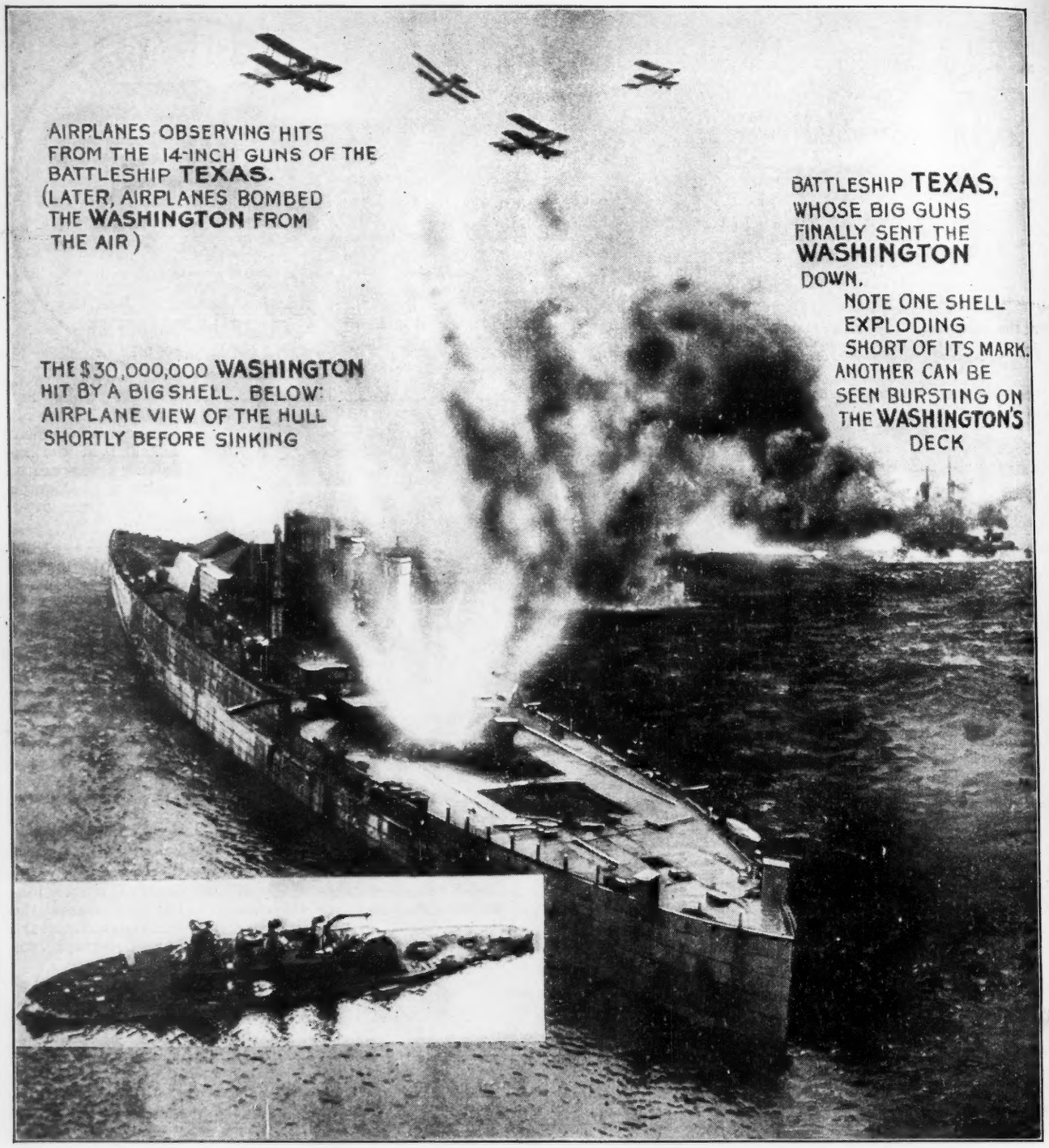
At about the same time that pictures were crossing the Atlantic on the wings of the ether, C. Francis Jenkins, of Washington, D. C., was demonstrating publicly his system of radio picture transmission, described in stages of its development in POPULAR SCIENCE MONTHLY for May, 1923, and June, 1924. The Jenkins method is based on the same scientific principles as that devised by the Radio Corporation, but reproduces the transmitted picture as a photograph, not as a pen-and-ink drawing.

Then, of course, there is the method of picture transmission over wires, developed a few months ago by engineers of the American Telephone & Telegraph Company and Western Electric Company, which also can be adapted to radio. Descriptions of this method were published in the August and October issues of last year's POPULAR SCIENCE MONTHLY.

### In the Laboratory

The laboratory apparatus used in perfecting the new radio photo system. Capt. R. H. Ranger, of the Radio Corporation of America, is seen at the right placing a film on the rotating transmitter drum. His assistant, A. J. Koenig, is seated at the left




AIRPLANES OBSERVING HITS FROM THE 14-INCH GUNS OF THE BATTLESHIP TEXAS. (LATER, AIRPLANES BOMBED THE WASHINGTON FROM THE AIR)
BATTLESHIP TEXAS, WHOSE BIG GUNS FINALLY SENT THE WASHINGTON DOWN. NOTE ONE SHELL EXPLODING SHORT OF ITS MARK. ANOTHER CAN BE SEEN BURSTING ON THE WASHINGTON'S DECK
THE $30,000,000 WASHINGTON HIT BY A BIG SHELL. BELOW: AIRPLANE VIEW OF THE HULL SHORTLY BEFORE SINKING

# The Sinking of a $30,000,000 Dreadnaught

IN THESE spectacular photographs of the recent sinking of Uncle Sam's $30,000,000 dreadnaught *Washington* off Cape Hatteras, after a terrific four-day bombardment by air and by sea, we have a vivid picture of a war that knows no truce: the never-ceasing rivalry between offensive weapon and defensive structure.

Military science tolerates the superiority of neither one. The moment bombs and shells can sink a ship or wreck a fort, then every expert flings himself upon the problem of defense. The minute armor defeats the hail of steel hurled against it, our military brains fly back to the problem of offense.

So it was with the *Washington*, which, by the Limitation of Armament Treaty, we were obligated to destroy.

"Our chance to prove we're right!" cried the gunnery experts and naval constructors in unison. Who won? Even the experts cannot say. For though the great ship finally sank, her sides sieved by 14-inch shells, the story might have been different had a crew been aboard. At Jutland ships fought on and won despite shot-holes and leaks.

The human aspect of this picture must not be misunderstood. The old horror of a raking fire that turned the war-ship's deck into a shambles no longer exists. The modern man-of-war drives into action with not a man in sight. Captain, gunnery officer, and navigator stand in their little conning tower. Through slits in 18-inch armor they watch the battle's progress. Through a score of telephones they direct the complex machinery of their swiftly moving ship. A direct hit from an aerial bomb would destroy this conning tower. At once the whole control would be taken up by a substitute command group in one of the heavily armored turrets.

# How Fast Can YOU Think?

## An expert tells how to score your mental ability by useful and fascinating tests that you can try on yourself

**By Donald A. Laird, Ph.D.**

JUST how bright are you? I don't mean, "How much do you know?"—because there is a difference. A filled fountain pen contains more liquid than an empty hogshead, but its capacity is not the same. How is your capacity for knowledge—your native intelligence that you have inherited from your parents, as opposed to the store of facts that your brain contains as a result of your schooling, your work, your reading, and your association with your fellows?

I am going to show you how you can test yourself, and see.

The tests you will find here are the kind given to college students to determine their mental abilities. They are an accurate measure of general intelligence—a quality that no amount of study will supply; a quality that the laborer, the mechanic, or the clerk who has not been through high school, or even grammar school, is quite as likely to possess as the man who has earned a college degree.

To know the measure of your own intelligence is highly important to you, and highly useful. It may show you, for example, that you are in the wrong job; that you are wasting your time in some occupation below your abilities, or that you are attempting to make your way in a business or profession that is beyond your powers.

How logical is your thinking? The word *elbow* indicates a part of the arm; *chimney* is a part of a house. Of what is a *speedometer* a part? While some one times you, call out the thing of which each of the words listed below is a part. Take the words in their order, skipping none.

Are you being timed? Ready. Go!

| | | |
|---|---|---|
| leaf | afternoon | Germany |
| nail | floor | week |
| quart | tooth | chimes |
| board | casters | Chicago |
| tire | beak | paper |

If you completed this test in 23 seconds, you are up to the average of college students. If you did it in less, you are brighter than the average college student.

It may seem strange to you that a simple test such as this—taking which is an exercise quite as fascinating as working the cross-word puzzles that are so popular now—should supply a reliable index to your intellectual powers. These tests, though, are not so simple as they may seem. They were devised by leading psychologists—by Dr. Alfred Binet in France, and by Dr. Henry H. Goddard, Dr. J. McKeen Cattell, and others in America, after long study of intelligent, dull, and superior persons, to find out what they really could do.

Now try a test of completion—that is, the ability of your mind to fill out an incompleted idea. With a pen or pencil fill in the blanks in this narrative, while some one keeps a record of the time it takes you to do this:

**It — sometimes said ——— women are more honest than ———. It may be ——— ——— are more honest ——— ——— long run, but there ——— ——— instances in which great ——— has been found in some ———. Such, —— ———, was the case —— the recent criminal ——— which has received newspaper ———. We are assured —— ——— honesty of the man in this particular ———, but the honesty of the ——— is open to serious ———.**

A college student will fill in these blanks in three minutes. Many persons who have never been to college, or even to high school, can better this time. For example, the members of a medical society in a Middle Western city were given a series of tests of general mental ability, such as you are taking on these pages. The same tests also were given to the employees of a contractor who wanted to use them in selecting the best workers.

Among a gang of pick-and-shovel laborers was found a man who got a higher score on the tests than the average physician had made! He was promptly transferred to a higher position that had been difficult to fill. Here the man was happier, because his new work permitted him to use more of his abilities, and because he no longer had to fool around at work that was not the right kind for him.

What is your range of information? Put a cross before each of the words in this list that you understand:

| | | |
|---|---|---|
| assay | Beelzebub | keel |
| assuage | Bessemer | nullify |
| astrology | blather | Othello |
| Audubon | Hauptmann | paunch |
| auk | hypothesis | revile |
| Bancroft | ichnography | scup |
| Mendel | incubus | Sudan |
| mammal | incognito | terrapin |

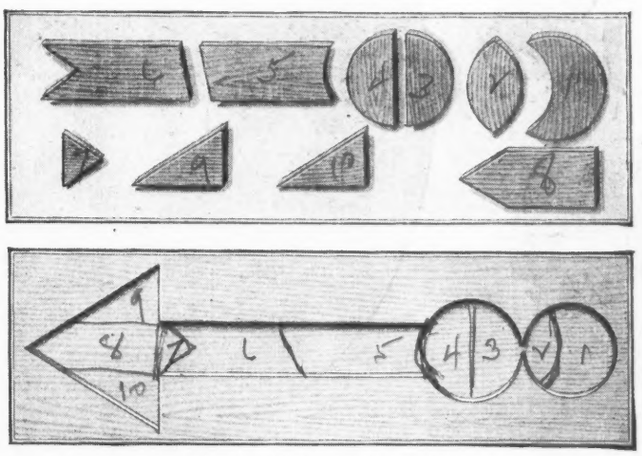
A college student will have 16 crosses.

Some of the funniest things imaginable are written in these tests at times. One college student, for example, said that Mark Twain was a steamboat; another that a revenue cutter was used on a milling machine. Another was working on a test in which the problem was to draw in with a pencil the missing parts of several pictures. One of the pictures was a pig, with the tail missing, and the student drew horns on the pig's head! I have found other students who were unable to detect that the eye was missing in a picture of a woman's face.

All of which is only another indication of what I said before—that going to college does not supply brains. Abraham Lincoln and Edison never went to college, but that they possessed intelligence nobody would deny.

How are you on numbers? Maybe accounting or some similar line of work is your forte. Try the following test, to see whether you have a natural aptitude for figures. While some one times you, check each group that contains a number 6. The average college student can do this in 40 seconds. If you can better this time appreciably, it is a sign that you probably have a "good head for figures."

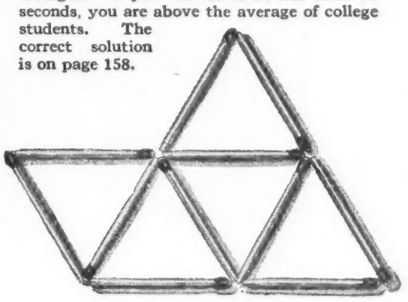
(*Continued on page 158*)



**Tests of Your Ingenuity**

Fig. 1. All the blocks in the upper picture fitted together properly form an arrow such as is shown in the lower picture. With your pencil outline on the arrow just how each part will fit. If you can do this in less than a minute, you are above the average in solving puzzling problems. You will find the correct solution on page 158.

Fig. 2. Arrange 11 matches as shown below. Remove three of them and leave two triangles. If you can do it in less than 10 seconds, you are above the average of college students. The correct solution is on page 158.

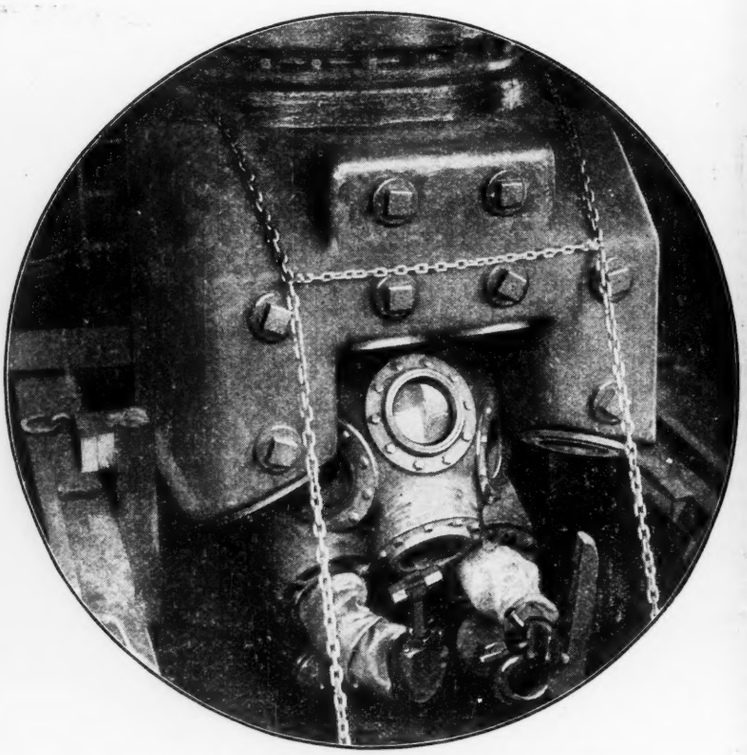


# Sunken Riches Lure

## Amazing New Deep-Sea Armor Revives

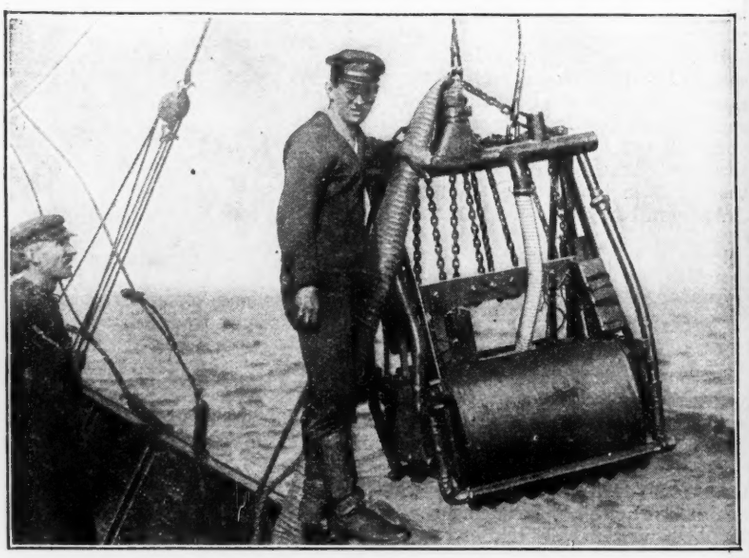
**May Recover *Lusitania's* Wealth**

Will the all-metal armor shown above enable divers to recover the $5,000,000 that went down with the *Lusitania*, and now lies in 285 feet of water? The inventor is confident of working 1000 feet under-sea. Notice how the diver is lowered by a crane



**A Work Chamber on the Ocean Floor**

Never before has the glamour of adventure in searching the seas for sunken treasure so appealed to men's imagination as it does today; for recent submarine inventions are making it possible to descend hundreds of feet beyond what heretofore has been the limit of human endurance. The armored chamber shown above is one of these new devices, invented by Capt. Charles Williamson of Norfolk, Va. Lowered from a floating barge, it rests on the sea floor, where the diver's hands are free for work. It is designed to descend to a depth of 800 feet. The greatest depth possible heretofore has been about 200 feet

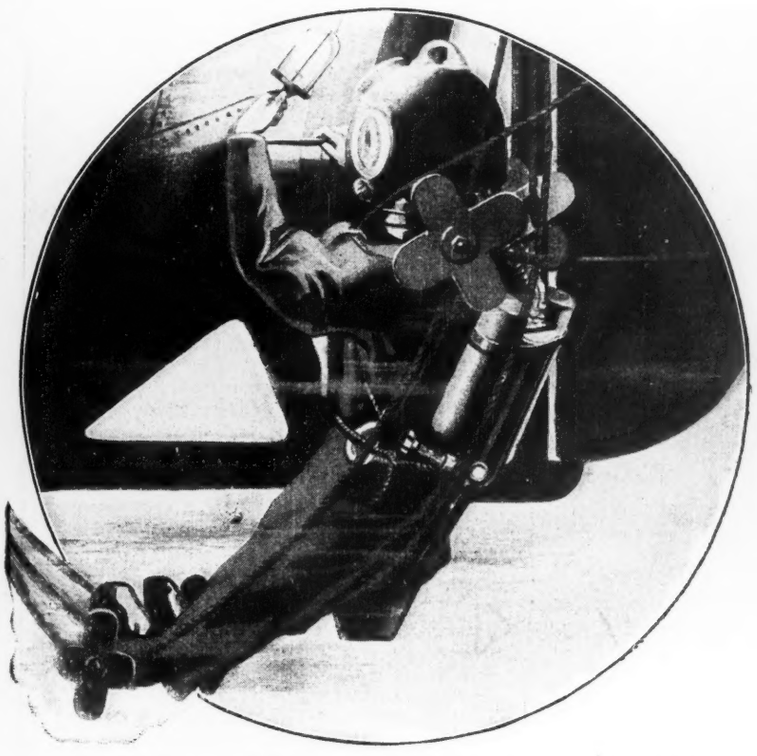


**Mechanical Claws Grapple for a Fortune**

With this apparatus—a combination grasper and sand sucker—two British contractors are attempting to salvage the famous English frigate *Lutine*, which sank off the northern coast of the Netherlands in 1797 with a cargo of gold estimated at about $5,000,000

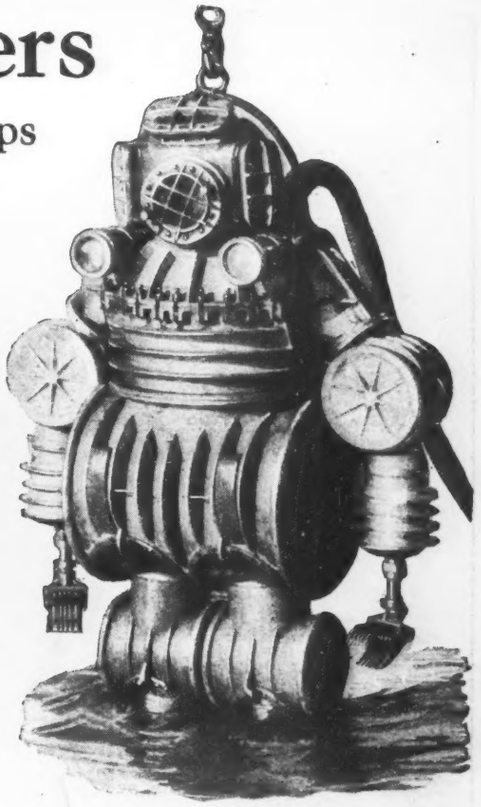
# Modern Adventurers

## Romantic Treasure Hunt in Wrecked Ships



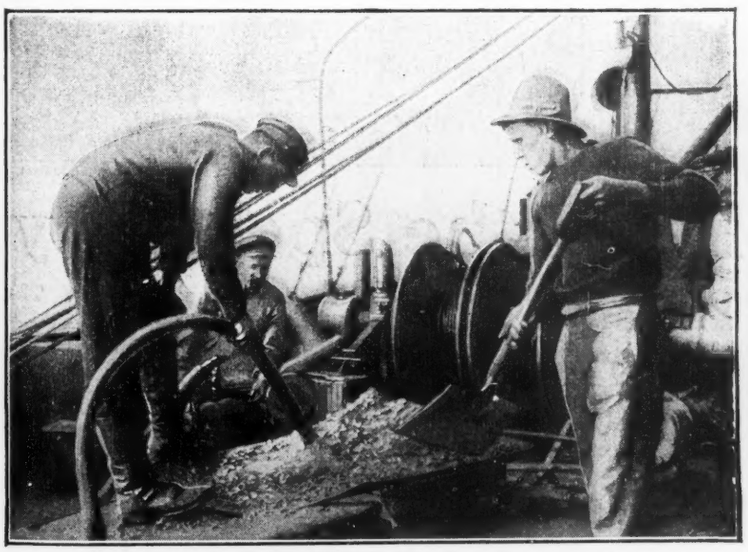
### How Divers Salvaged $30,000,000 from *Laurentic*

The recent dramatic success of divers in recovering a golden cargo worth $30,000,000 from the wreck of the *Laurentic*, sunk by a submarine off the northern Coast of Ireland in 1917, has spurred other adventurers to seek more of the sea's treasures. Only a few weeks ago, four young Americans located the wreck of the Ward liner *Merida*, which went down in a collision off the Virginia capes in 1911. They are at work to recover her cargo of gold, silver, and jewels—a prize estimated at from $2,000,000 to $5,000,000. The above illustration shows how divers worked on the hull of the *Laurentic*, which sank in 90 feet of water



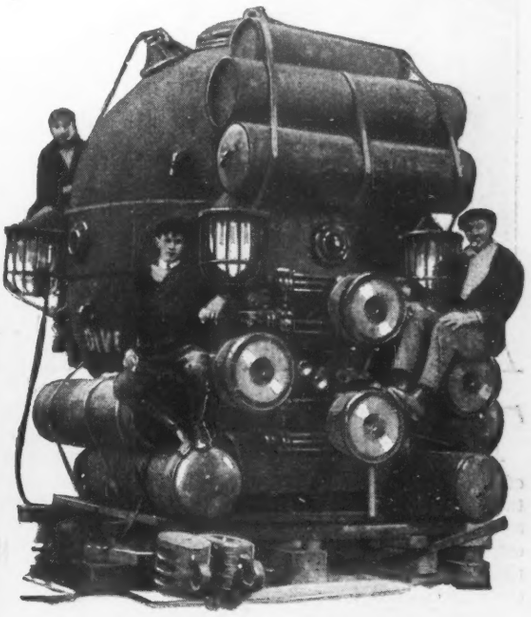
### A Mechanical Sea Monster

Picture this weird steel monster groping in the murky depths off the coast of Scotland in search of the fabulous treasures that went down with the Spanish Armada more than three centuries ago. Then you will have a real modern romance. The armor is so heavy that a man would be unable to move with it on land. It is electrically operated throughout. Notice particularly the claws that have the power of the combined grip of 100 men



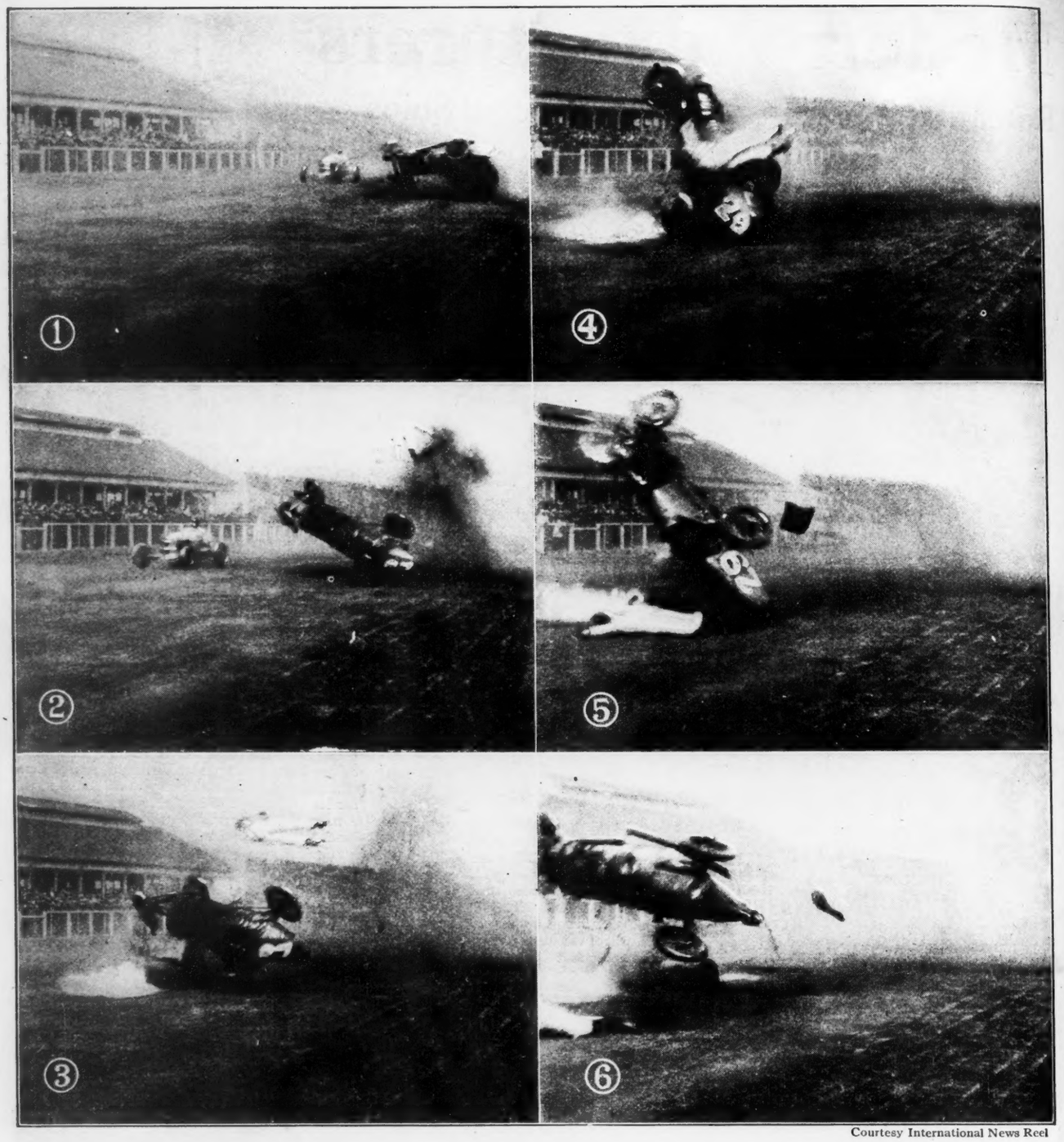
### Washing Gold from the Ocean's Sand

In seeking riches buried with the frigate *Lutine* in 45 feet of sand, the earth and sand brought up by the grasper shown on the opposite page are carefully washed to recover gold and silver, as in the illustration



### Remains under Sea Four Hours

It is claimed that four men can remain under the sea four hours in this huge diving bell recently tested near New York City. The four white disks are magnets by which the bell attaches itself firmly to a sunken ship during salvaging operations



Courtesy International News Reel

# A Thrilling Spill on the Speedway

THESE six photographs are reproduced from what is probably the most remarkable motion picture of an automobile racing accident ever taken. They show a racing car turning a complete somersault on the track, catapulting the driver high into the air; then, as he falls to earth again, rolling over upon him to crush out his life.

It was by chance that such a dramatic picture story was obtained. The camera man was at the race track at Hawthorne, Ill., recently, "shooting" pictures of a preliminary tryout. Suddenly a streamlined racer driven by Norbert Wylie, approaching the grand-stands at a speed of more than 90 miles an hour, was sideswiped by another car. Wylie's machine careened in a dizzy spin, toppled over and somersaulted. There was a sickening crash, and the driver lay dead beneath the thundering speed machine of which a moment before he had been the master.

IT WAS all over so quickly that the amazed spectators hardly knew what had happened, yet the camera's unerring eye had caught every detail of the tragedy.

In picture 1 the ill-fated car is seen at the instant the driver lost control. It has skidded sharply and is tilted up sidewise on two wheels, about to roll over.

2. A fraction of a second later. The car has turned upside down, hurling the driver into the air.

3. Wylie is seen falling in the path of the plunging machine.

4. Here the car has risen on its haunches, while the falling driver has almost reached the ground.

5. Like some brutal monster, the machine, digging its sharp tail into the track, lifts itself upward, ready to strike at its fallen master. Notice the seat cushion leaving the car at the right.

6. The instant before the fatal crash, with the racing automobile completely off the ground.

# Automatic Controls to Make Our Trains Safer

## How Machinery Prevents Collisions when Human Hands Fail

By Norman C. McLoud

IN THE vestibule of a limited train recently I saw the conductor, startled into sudden action, throw open the outside door and look backward. With his first move he pulled the overhead emergency cord. The swiftly speeding train jerked to a standstill in a manner that must have surprised the engineer as much as it jolted all the passengers.

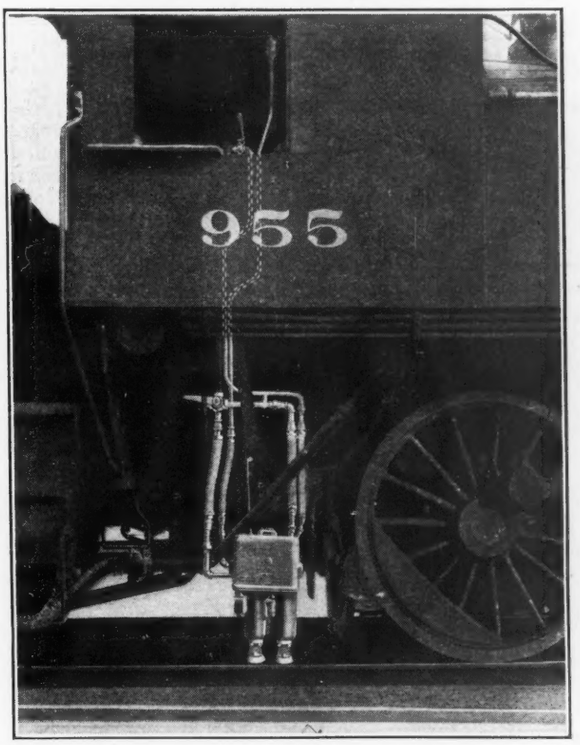
In passing a signal tower the conductor had caught a flashing glimpse of the operator lurching unsteadily toward a window. Investigation revealed that the man had developed a sudden attack of illness and had fallen unconscious. Since the tower stood at the crossing of another important railway, the alertness of the conductor had made it possible to prevent disaster.

This incident of travel illustrates the importance of automatic train control, now mandatory for the first time in the history of the United States. The requirements became effective January 1, after several years of preparation. They were imposed by the Interstate Commerce Commission through peremptory orders addressed to 49 important railways, issued in June, 1922, and stipulating that each road, within 2½ years, should properly safeguard at least one full passenger locomotive division of main-line track.

Automatic control is intended to do what was done by the conductor in the case of the fainting signal operator—and do it without waiting for human prompting. Its chief function is to prevent collisions, of which, in 1923, there were 938 on railroads of the United States, resulting in the death of 83 persons and the injury of 1660 others.

To reduce this costly toll by safeguarding against the failure of the human factor in railroad operation, 49 roads have installed automatic equipment on an average of 100 miles of track apiece. This means about 5000 miles of American railways under automatic control.

The new devices are designed to guard against such possibilities as the sudden death of an operator in his tower or of an engineer in the cab of his locomotive, and to protect the train against the unexpected stoppage of a train ahead, the approach toward a broken rail, or the peril of an open switch. They remove the danger that impends when a signal is obscured by fog, smoke, or other causes.

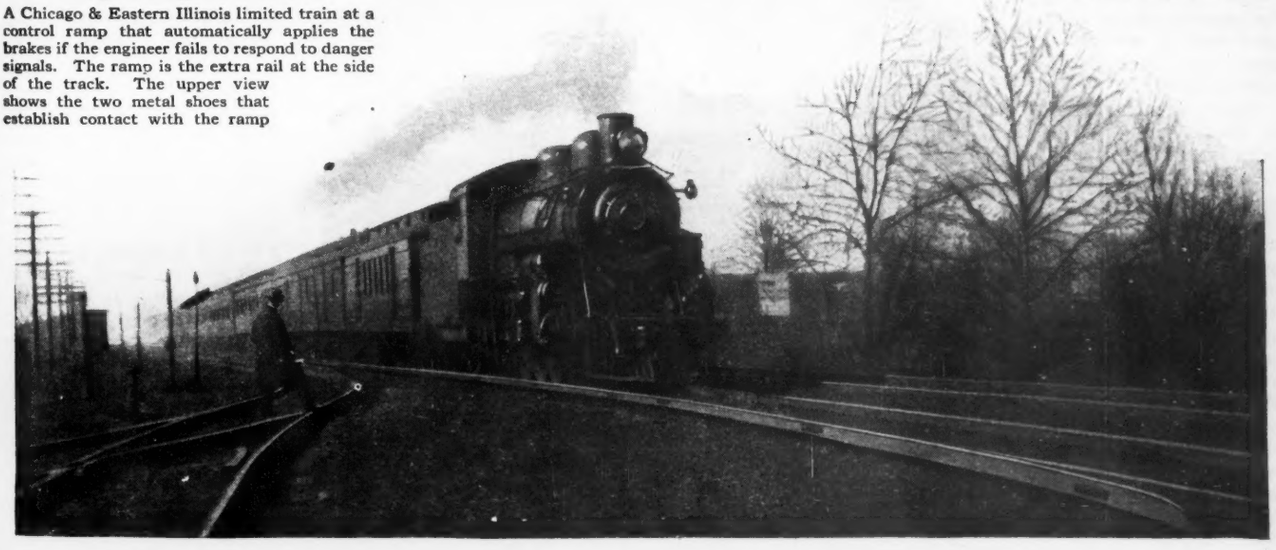



AUTOMATIC train-control devices are of three general types: The ramp system, electrical induction, and magnetic induction. All convey to the locomotive cab detailed information concerning the state of the track ahead. This is accomplished through electric circuits of which the rails are the basic factor. When necessary, the devices seize control of the train and bring it to a standstill by sharp application of the air brakes.

The ramp system uses short lengths of a third rail, placed alongside the track at the approach to a wayside signal. This rail, or ramp, is somewhat higher than the regular rail, and slopes at each end. The locomotive is equipped with two metal shoes, arranged so that they establish contact with the ramp. When the shoes slide up the incline at the end of the ramp, one of two things will happen. If there is a train that is too near ahead, a broken rail, or an open switch, the rising motion of the

**Safeguarding the Limited**

A Chicago & Eastern Illinois limited train at a control ramp that automatically applies the brakes if the engineer fails to respond to danger signals. The ramp is the extra rail at the side of the track. The upper view shows the two metal shoes that establish contact with the ramp



shoe operates a plunger that causes the completed circuit to apply the automatic brakes. On the other hand, if the track is clear, the rising motion is nullified by a contact device and brakes are not used.

The electrical-induction and magnetic-induction systems dispense with the intermittent ramp and operate continuously. Information concerning the track ahead is transmitted through the rail circuit and reaches the cab by means of induction, through the medium of coils or magnets placed alongside the rails. The locomotive is equipped with receivers to pick up the induction impulse from the coils or magnets. The impulse thus communicated actuates the control apparatus aboard the locomotive and applies the brakes when necessary.

In some devices the impulses picked up by the receivers are said to be of sufficient strength to be used without amplification. In others the designers have provided for amplifying the impulses by vacuum tubes, similar to those used in radio.

In the cab of an automatically controlled train in which I made a recent trip, the engineer sat facing an interior outfit of signals, consisting of three electric lamps controlled by a speed indicator acting on the principle of a centrifugal governor. The apparatus was set to prevent speed of more than 60 miles an hour.

For some distance we moved at less than 60 miles an hour. On a slight down grade the speed increased until the indicator was above the prescribed limit, warning the engineer that he must reduce his rate of travel. The warning disappeared as soon as the excessive speed had been eliminated.

"It was up to me to slow down quickly," the engineer told me, with a good-natured grin. "If I hadn't, the blamed thing would have taken the train away from me."

Therein lies one of the important factors of automatic control. As long as the engineer is on the alert, he loses none of his responsibility or command. But if he fails to heed the warning the brakes are applied automatically. He could not have allowed his train to maintain the high speed if he had tried. The centrifugal governor would have applied the brakes without a second warning.

Tests on the Erie Railway have produced striking results. Passenger trains of eight steel cars, running at 47 miles an hour, always have been stopped automatically within 1200 feet from the time of the automatic application of the brakes. Under company rules the normal allowance is 1600 feet. Freight trains averaging 79 cars, with weight of 6326 tons to the train, achieved stops within an average distance of 1713 feet, from a speed of 30 miles an hour.

The program of the Interstate Commerce Commission contemplates expansion of the automatic control to all roads.

# Artificial Throat Returns Speech to Cancer Sufferers

TWO men stood on a platform in Baltimore, Md., recently before a gathering of surgeons. Neither had spoken in several years, their vocal cords having been removed in operations for cancer of the throat. They attempted to speak, but the results were only slight hisses from their lips and louder sibilant sounds as the air from their lungs sighed through the apertures in their throats left by the surgeons' knives.

Then Dr. John E. Mackenty, well-known laryngological surgeon, of New York, handed to each man a little device of rubber tubing and silver, quite like some odd form of smoking pipe. The rubber tube each man affixed to a pad that was strapped to his throat over the hole through which he had been breathing since the operation that had taken his voice away. The other end of the apparatus—a tube of hard rubber resembling a pipe stem—each placed inside his mouth.

Again the men attempted to speak, and this time there issued from their lips intelligible, articulate speech!

This was the first semi-public demonstration of the artificial larynx, an amazing device developed by Dr. Harvey Fletcher, Raymond L. Wegel, and Clarence E. Lane, engineers of the Western Electric Company, which ends the hitherto hopeless silence of those who have lost their vocal cords in operations for cancer.

The artificial larynx is not at all a complicated apparatus. It consists merely of a pad, strapped over the breathing aperture in the patient's throat, a rubber tube through which air is carried from the lungs, a little cylindrical box containing a diaphragm of thin rubber, and another tube by which the air set into vibration by the rubber diaphragm is carried to the mouth. Movements of the lips and tongue then form the speech sounds just as in the normal act of speaking.

The result is speech that is entirely intelligible with volume enough to carry across a large room. Unlike natural speech, however, it is delivered in a monotone, since the rubber diaphragm that simulates the vocal cords cannot be stretched and compressed at will to produce variations in pitch. Fourteen persons have been using an earlier and less perfect form of the invention for about a year. Now, though, the artificial larynx will be manufactured in quantities that will make it available to all who require it. No attempt will be made to market it on a profitable basis, it is announced. Those who require one, yet cannot afford it will be loaned one. To those who can afford it, the price will be the exact cost of manufacture.

**When Science Gives Back the Power of Speech**

How a victim of cancer of the throat uses the new artificial larynx that gives him back the power of speech, is shown by the figure on the left. An engineer of the Western Electric Company is demonstrating to him part of the invention that simulates the action of the human vocal cords, removed in the operation for cancer. The patient is holding in his hand the box containing artificial vocal cords. These are actuated by air carried through a rubber tube from a hole in the patient's throat, while the patient forms the sounds of speech with his mouth through a tube resembling a pipe stem. The diagram at upper left shows how the mechanism is substituted for the larynx, removed in an operation for cancer

CANCER of the throat is extremely malignant, and victims survive only from 18 months to two years without an operation. Any form of local irritation may lead to the development of the disease, common contributing causes being excessive talking or shouting, excessive smoking, and bad liquor. Since it is a disease not often encountered, sometimes it is not recognized at once by physicians.

The operation is exceedingly delicate, necessitating the removal of the larynx (the Adam's apple) and the adjacent parts of the throat. One of the final steps in the operation is carrying the upper end of the windpipe forward into the wound and sewing it up in such a way that the windpipe communicates directly with the outer air. Henceforth the patient breathes through this aperture and not through his mouth.

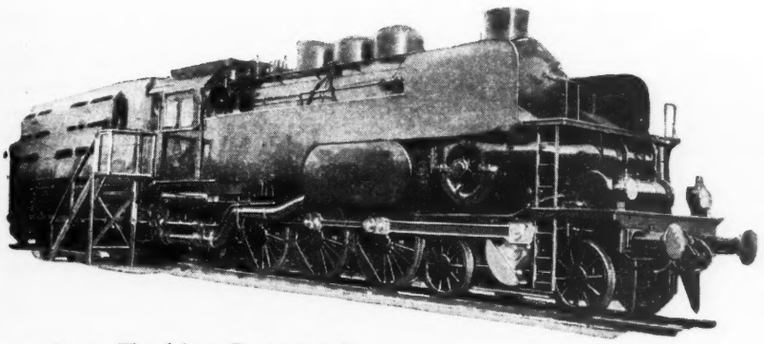
The artificial larynx may be used by the patient almost as soon as the wound in his throat has healed. The pad is strapped to his neck continuously, with a layer of gauze underneath to keep the dust out of his lungs. When he wishes to talk, he parts his shirt just below the collar-button, and attaches the rubber tube. Very little practice is required for the user to become expert, and thereafter talking imposes no strain either on speaker or listener.

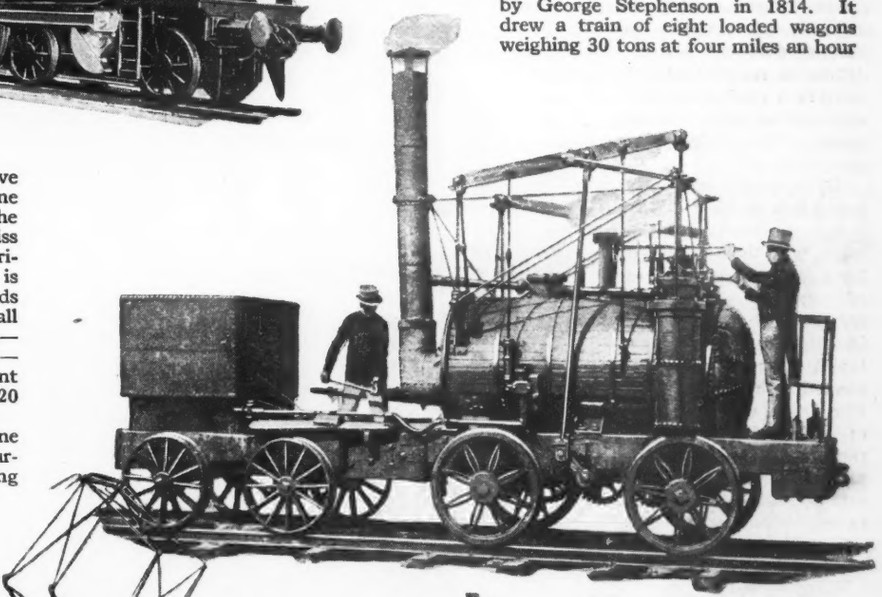
# Newest Locomotive Marvels

## Giants of Electricity and Steam to Pull Our Trains

LESS than a century ago the grotesque wood-burning locomotives that hauled American trains did well if they could take a short train along a straight stretch of level track at 25 miles an hour. In less than a century these crude engines have been developed into the giants of electricity and steam that today carry us across the continent in less than five days and pull tremendous loads over mountain ranges.

Below is pictured a duplicate of one of the world's first locomotives, the "Blucher," built by George Stephenson in 1814. It drew a train of eight loaded wagons weighing 30 tons at four miles an hour





### New Turbine Locomotive

That the common type of piston locomotive is doomed, and will be succeeded by a turbine locomotive that is 10 times as efficient, was the recent statement of Henry Zoelly, noted Swiss locomotive engineer, in a report to the American Society of Mechanical Engineers. "It is positively pitiful," he said, "to see thousands of locomotives running with maximum over-all efficiencies of from seven to nine per cent—very often as low as five or six per cent—whereas an up-to-date stationary steam plant attains with ease efficiencies in excess of 20 per cent."

Above is one of the newest types of turbine locomotives perfected in Germany. The turbine engine differs from the usual reciprocating engine in that the steam pressure, instead of being exerted against pistons, drives against a series of vanes or buckets on a rotating wheel, greatly reducing friction

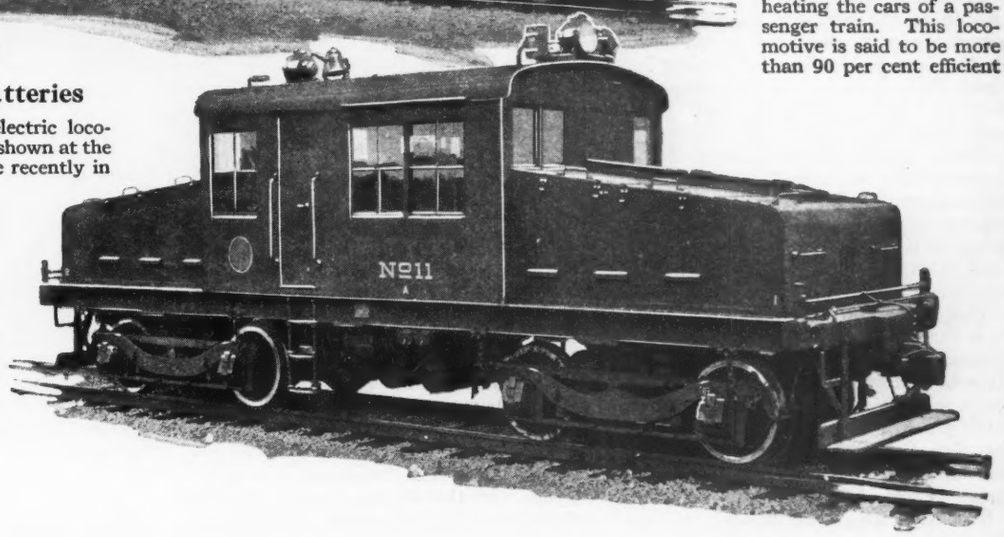
### Gearless Giant

One of the most efficient of the new electric locomotives is the high-speed gearless type shown at the left, used in the mountains of the Pacific Northwest. The motor armatures are mounted directly on the axles, 12 in number. The total weight of the drivers is 458,000 pounds.

The locomotive is in two similar units. Between them is a cab containing a boiler plant for heating the cars of a passenger train. This locomotive is said to be more than 90 per cent efficient

### Run by Storage Batteries

The largest storage-battery electric locomotive in the United States is shown at the right. It was put into service recently in the yards of the General Electric Company at Schenectady, N. Y., and is to be used for switching on interconnecting track systems. Because of the necessity of recharging its batteries frequently, it is to be used only in a restricted area. The batteries consist of 100 cells with a total current capacity of about 1080 ampere hours, or 216 kilowatt hours



# Speedy Airplanes to Conquer

## Thrilling Stories of Mail Routes that Have Cost

WHEN the United States mail-carrier put on the uniform of an aviator, from all over the country came warnings of disaster. Airplanes sweeping through the black of night, struggling against wild storms, pilots guided only by feeble lights flickering upward at long intervals, deserts and mountains to be crossed, with help difficult to procure in case of accident—all introduced an element of peril into what should be surrounded with utmost safety—the delivery of our daily letters.

But was danger really being introduced?

On the contrary, the way was being paved for a far greater measure of safety in the postal service. Those who live in cities and towns may laugh at the assertion as absurd; but it is not. For there are hundreds of Uncle Sam's postal routes where an airplane would represent the safest possible method of travel—security for the carrier such as he never dreamed of. These are what are called the "star routes"—the postal byways in the remote ends of the nation, where the carrier faces death and injury virtually every time he fares forth with his sack. Avalanches, floods, blizzards, drifting ice—these and other hazards of nature contribute to the perils of the carrier who serves the outposts of the postal service. In the last 30 months 55 carriers have given their lives in the performance of duty, and many others have been crippled and otherwise injured.

These unsung heroes of the nation are the ones who will benefit more than any others from the introduction of the airplane and other gifts of science such as the motorized snowsled and power iceboat into the equipment of the postal service.

The motorized sled, recently invented by a Finnish scientist, has aroused much interest in the Post Office Department. Here is a device that undoubtedly will prove an efficient ally to the airplane in cutting down the frightful toll in lives that for years has seemed inevitable in delivering the mails to such places as the frozen wastes of Alaska.

Recently an experimental air-mail service was introduced in Alaska. What had been a 35-day trip by dog sled was completed in less than six hours. It was shown that surface temperature could drop to five below zero and even lower, without offering obstacles to the satisfactory operation of the planes. Rugged mountains with passes blocked by avalanches were crossed easily. With motorized sleds to distribute the mail brought in bulk by the airplane, the perils of the carriers in these barren, snow-swept reaches virtually would disappear.

Likewise, the successful establishment of transcontinental air-mail service, cutting the traveling time between New York City and San Francisco from four days to 34 hours, offers the possibility of covering perilous mail routes that now are served at tremendous risk. Such a one, for example, as that which extends from Detroit Harbor, Wis., past "Death's Door." This stretch of travel is on the Lake Michigan water route that forms the sole channel of communication between Ellison Bay and the community of Detroit Harbor. In open weather the route is without difficulties. From November to May it carries dangers that prove that "Death's Door" is well named.

THE chief trouble comes from drifting ice-fields. Extremely cold weather brings about the formation of an ice-bridge, but this seldom remains for more than a few days at a time. Shifting gales and strong currents usually make short work of it. Sometimes the break-up occurs when the carrier is on the ice with horse and sleigh. The sudden collapse brings great danger, and more than one carrier owes his rescue to the quick work of the coastguard crew stationed on Plum Island, close at hand.

One rescue of a carrier from the break-up was full of thrills. With the destruction of his pathway, the man found himself on an ice cake barely large enough to hold himself, his horse, and his sleigh. The crew of the coastguard station saw his situation and rushed to his aid.

Broken ice surrounded the marooned carrier and made it impossible to reach him, so the coastguards were forced to combine seamanship with the methods of the plains. Their line became a lariat. They lassoed the cake of ice, towed it through the water and over the surface of the ice until they brought carrier, horse, and sleigh to a place of safety.

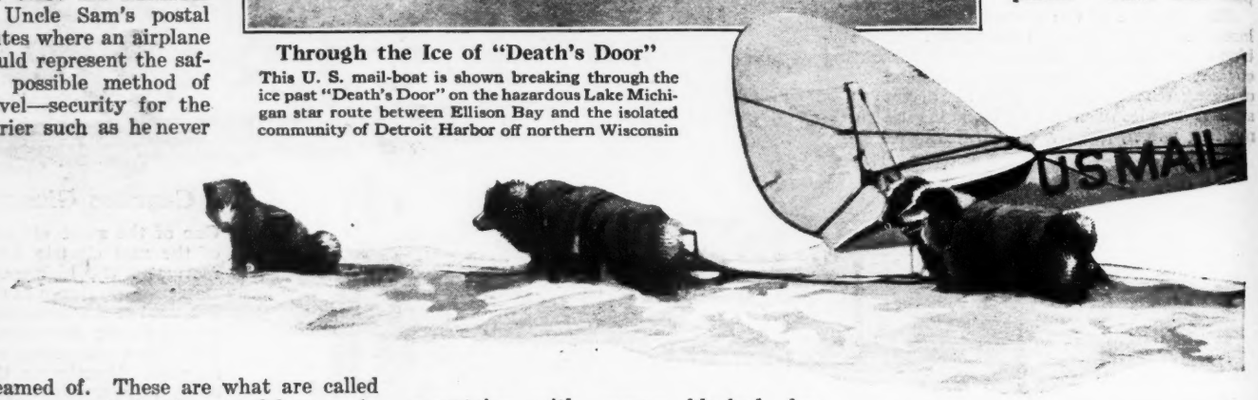
Bucking the slush ice is another peril of the carrier who serves the route through Death's Door. When the carrier cannot find solid footing for his horse and sleigh, he uses a launch. Sometimes the slush is eight or 10 feet deep and impassable, in which case the carrier must fight his way back to the starting point and seek a fresh channel. At times the boat is caught in the drifting ice and carried out into Lake Michigan overnight.

Ellison post office is on Washington Island, an area with a population of one thousand. During severe weather the island may be without mail for five or six days. Such interruptions are serious, for the residents depend entirely on the postal service for contact with the outside world. The parcel post is their sole source of supply for medicine, provisions, and other necessities.

In this case the mail-plane would remove the dangers of Death's Door and

**Through the Ice of "Death's Door"**

This U. S. mail-boat is shown breaking through the ice past "Death's Door" on the hazardous Lake Michigan star route between Ellison Bay and the isolated community of Detroit Harbor off northern Wisconsin



# Perils of U. S. Postal Trails

## the Lives of Many of Uncle Sam's Hardy Carriers

establish contact with the mainland with fine scorn of ice conditions. The entire trip could be made in the time it now takes for a carrier to launch his boat from an ice floe. And if landing proved too hazardous for planes under adverse conditions, it would be a comparatively simple matter to drop the mail-bags to earth.

LAKE ERIE, too, offers generous field for the mail-plane. The waters of this inland sea are a clearing house for perils of the postal routes. Important communities are located on the numerous islands lying opposite Sandusky, Marblehead, and other points on the Ohio mainland. To serve these islands with their winter mail involves grave risks. The dramatic adventure of the Hitchcock brothers is a living tradition with the islanders. The incident happened some winters ago, but it is still told as an example of what the carriers must face.

The Hitchcocks had started for some of the smaller islands when they were caught in a violent storm and a heavy sea of running ice. They could do nothing but run with the gale and the perilous drifting ice-field in which they had become wedged. They were swiftly carried down the lake and the islanders gave them up as lost. As a final resort a cable message was sent to Kelleys Island.

"Look out for the mail-carriers," the message read. "They are fast in the ice and drifting your way."

Rescue parties were swiftly organized. Operations were concentrated at a point at which the drift was nearest shore, and here the brothers were rescued. Assistance came none too soon. The two men were exhausted and helpless. Their caps were frozen to their heads and their clothing so completely covered and weighted with ice that they could not move. More than a bushel of ice was chopped from their garments after the rescue.

The ironclad is one of the institutions of Lake Erie. Perhaps it is best described as a combination sailboat, rowboat, ice-yacht and sled. When it can't be moved as one, it becomes another. In a single journey it may be all four. The craft is a flat-bottomed skiff. For sailing in open water or on smooth ice the boat carries a sail. On the bottom are iron-shod runners for sledding. The sides are sheathed with galvanized iron as protection from the knife-blade edges of thin ice. Without this sheathing the ice would make short work of the wooden shell.

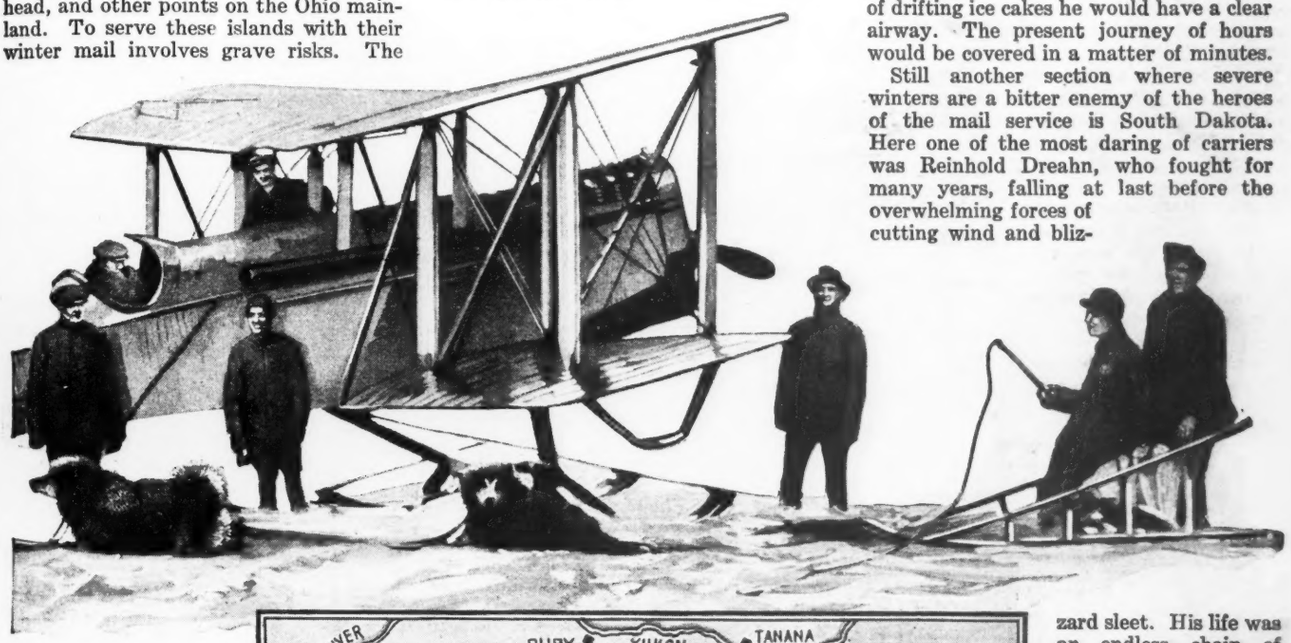
PICTURE the condition of the isolated Lake Erie communities under a system of air-mail transport. Instead of facing the dangers of ice- and storm-swept seas, the carrier would cross the water at an altitude insuring complete independence of surface perils. Instead of drifting ice cakes he would have a clear airway. The present journey of hours would be covered in a matter of minutes.

Still another section where severe winters are a bitter enemy of the heroes of the mail service is South Dakota. Here one of the most daring of carriers was Reinhold Dreahn, who fought for many years, falling at last before the overwhelming forces of cutting wind and blizzard sleet. His life was an endless chain of journeys between the post offices at Murchison and Buffalo. Storms found him unafraid. His one creed of service was that the mails must move—the creed that finds unfailing expression in the work of the postal servants everywhere.

One Saturday afternoon last winter Dreahn left Murchison for Buffalo on his semi-weekly trip. A fierce snowstorm was raging. With nightfall the cold became intense. Buffalo knew the man and his record and awaited his arrival with quiet confidence.

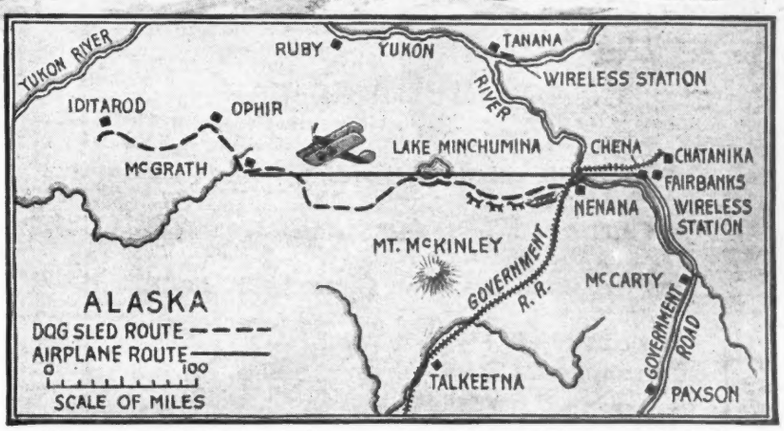
But when on the Sunday Dreahn failed to appear, all Buffalo became anxious, and searching parties were organized. It was too late. Dreahn had made his last trip. He had fought his way to within a few hundred yards of the town, only to lose the struggle in sight of safety

(Continued on page 155)



**Old and New**

Above is Alaska's first air-mail plane, and beside it is one of the dog teams that it is replacing. Experimental air-mail service between Fairbanks and McGrath—a distance of 300 miles—has proved that what formerly was a perilous 35-day trip by dog sled can be completed now with safety in less than six hours




Map showing the direct 300-mile air-mail route between Fairbanks and McGrath, Alaska, as compared with the winding and much longer dog-sled route that it replaces

# First Aid for Your Family

## What you should keep in your medicine cabinet for every emergency—How to safeguard against mistakes

By John F. Anderson, M.D.

WHEN you open the door of your medicine cabinet, what do you see on its narrow shelves? Do you see articles that should be there for every possible emergency, and of which your family physician would approve; or do you see articles he would not approve, and many of which may be dangerous or at least unsafe?

The medicine cabinet should be well stocked and well lighted for any emergency, says Doctor Anderson

The daily papers tell us too often the story of what has happened to some one, usually as the result of a night call on the contents of the medicine cabinet, because there was included a dangerous drug among the real household emergency products of harmless character! Some member of the family, groping around in the dark, picks up the wrong bottle, and the mistake is not discovered until it is too late.

These deplorable and preventable accidents usually are due to the inadvertent swallowing of either one of the coal-tar disinfectants such as carbolic acid, cresol or the like, or tablets of bichloride of mercury.

Dangerous drugs should be banned from every household medicine cabinet.

The household medicine cabinet should be in the best lighted part of the bathroom, and so placed that when the mirror-fronted door is open, a light shines full upon its contents. It should be painted and kept in spotless white, and its shelves preferably should be of glass.

What should we find on the shelves of this household emergency drug-store?

Suppose we start our list with those products that may be used for the relief of indigestion and constipation, the two great American complaints. Sodium bicarbonate should be there for the first of these: A liberal pinch in half a glass of water is a good remedy for "heartburn" and other symptoms of indigestion.

Bicarbonate of soda also relieves the sting of insect bites, eases the pain of superficial burns; may be used in solution as a gargle for a sore throat, and in a bath for tired feet. Truly this is the most useful of the contents of the medicine cabinet.

For the relief of sluggish bowels or habitual constipation, there should be mineral oil, or liquid petrolatum, as the doctors call it; Epsom salts and castor oil (the tasteless kind for children).

AS WE have banned carbolic acid and the like, as well as bichloride of mercury, we should replace these dangerous disinfectants by others. In their place let us put in tincture of iodine to be used as an application to cuts and wounds before the doctor arrives; chloramine-T as a general disinfectant and dressing for wounds of various kinds, particularly infected ones; boric acid as a prophylactic antiseptic and particularly for use in a solution as an eye wash, or douche.

We must not omit a benzoinated cream to be used for the relief of chafing as well as chapped hands and lips, and as an application to insect bites.

A tube of analgesic balm will often be found useful for rubbing in cases of neuralgia or lumbago, over bruises, painful and swollen joints, and as a counter-irritant in general.

Milk of magnesia is recommended by dentists as a mouth wash and by physicians as an anti-acid and mild laxative; it should therefore be in the medicine cabinet. For solutions to be used as gargles, bicarbonate of soda or a solution of sodium chloride or table salt will do well.

While persistent headaches give warning that there may be some organic condition requiring the advice and services of a physician, there are nevertheless times when there is need of something to relieve a headache or pain of a severity and extent not requiring the services of a doctor. The best all-round product to include in the medicine cabinet for this purpose is aspirin.

For these uses the old-time medicine cabinet was likely to contain acetanilid or phenacetin or even something more harmful; but aspirin has largely displaced them. Aspirin now is prescribed in the early stages of a head

(Continued on page 156)

### For Your Shelves

*The following list was compiled by Doctor Anderson, who formerly was Director of the Hygienic Laboratory of the U. S. Public Service, and who now is Director of the Biologic Laboratories of E. R. Squibb & Sons, New York City.*

**Sodium Bicarbonate**—For indigestion, insect bites, slight burns, sore throat, tired feet.

**Epsom Salts and Castor Oil**—For constipation and as a laxative.

**Tincture of Iodine**—An emergency disinfectant for cuts and wounds.

**Sterile Bandages and Gauze**—For dressing wounds in emergency.

**Boric Acid**—Eye wash or douche.

**Benzoinated Cream**—Relieves chafing, chapped hands, or insect bites.

**Analgesic Balm** — For neuralgia or lumbago, bruises, painful and swollen joints.

**Milk of Magnesia**—Mouth wash, mild laxative.

**Aspirin**—For headache or head cold.

**Zinc Ointment**—To relieve skin inflammation caused by poison ivy or poison oak.

**Aromatic Spirits of Ammonia**—For fainting, nervousness, or giddiness.

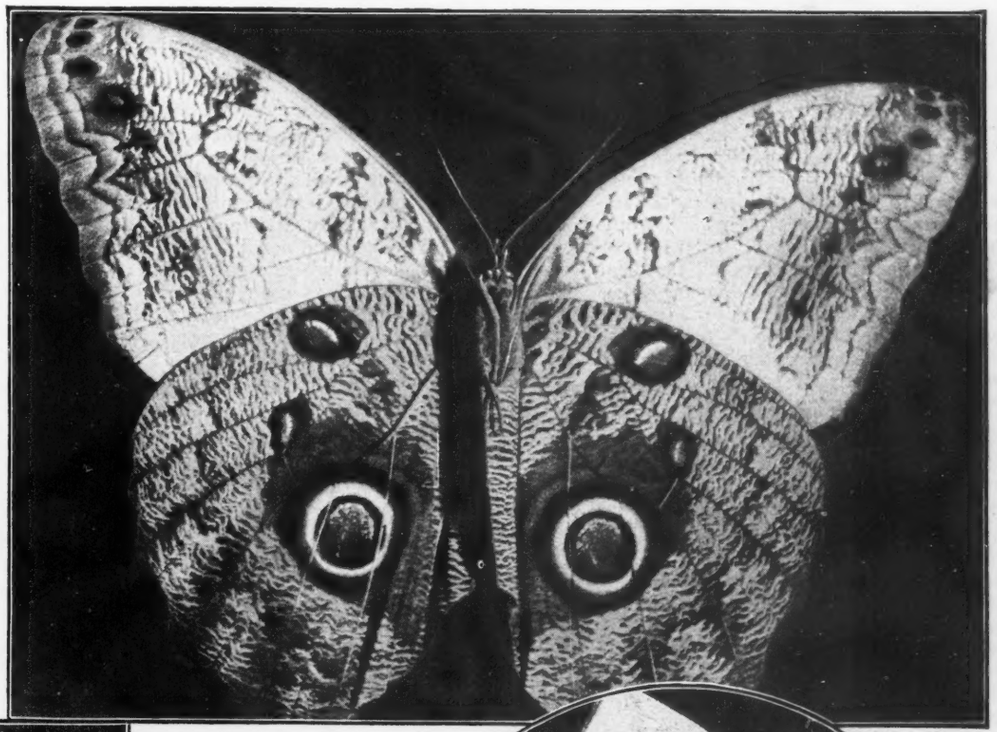
**Thromboplastin**—For nose-bleed.

# Gay Deceivers among the Insects

## Nature's Clever Camouflage Protects Them from Enemies

THE world's foremost artisan in camouflage is Nature herself. To protect her creations she has endowed them with amazing tricks of deception. There are plants that entice unsuspecting insects to destruction by alluring flowers and imitation drops of honey. In the sea are countless creatures that conceal themselves from their enemies by transparency or by changing their colors. On land and sea are other creatures, naturally harmless, that are made to appear ferocious.

Among the insects, an astonishing example of this protective deceit is the butterfly pictured at the right. This butterfly is protected from birds that are the prey of owls by the markings on its wings resembling the face of the owl. You will see how striking this resemblance is if you turn the picture so that it is upside down



Courtesy Educational Film Exchange, Inc.

Look at the twigs in the photograph below and see if you can find an insect. If you examine them carefully, you will see one long stick with legs and antennae. This is the Bacillus rossii, commonly known as the "walking-stick." It belongs to the grasshopper family, and is the color of tree-bark

Courtesy Educational Film Exchange, Inc.

At first glance, would you believe that the tree trunk pictured above held one of the gayest of moths? When in flight the Catocala flashes brightly colored blue hind wings; but as soon as it comes to rest, these brilliant wings are concealed beneath dingy fore wings that almost exactly match the bark of a tree. In this way, it can rest with the assurance of comparative safety from the birds that prey upon it

You would have to look twice, wouldn't you, to tell that the object pictured above was other than just a plain leaf? This is one of several species of butterfly that are protected by their wonderful imitation of green or dead leaves. The camouflage is so realistic that even the nerve veins running through the wings duplicate the veins of a leaf. In some cases the butterflies appear to be weather-worn leaves

# Crash of Electrons Heard

## How invisible bombardments by the smallest particles of matter are magnified a million times—Seconds split into a billion parts—A promising treatment of tuberculosis—Other important new mileposts in the march of science

EXCEEDINGLY faint sounds often are compared with the drop of a pin. Can you imagine, though, listening to sounds beside which the impact of a pin on a soft rug would be like a clap of thunder?

Two American scientists did just that recently, when they devised an apparatus by which they were able to hear electrons, which, as you know, are the smallest known particles of matter—infinitesimal charges of electricity so tiny that their exact size could scarcely be computed if we were able to divide a millionth of an inch into a million parts.

Dr. A. W. Hull of the General Electric Company, Schenectady, N. Y., and Dr. N. H. Williams of the University of Michigan, are the two scientists who have succeeded in listening to the inaudible. By means of a vacuum-tube amplifier, they heard in a loudspeaker the bombardment of electrons against the plate of a vacuum tube.

Such laboratory feats are highly important in bringing us closer to a knowledge of the exact nature of that mighty force electricity, of which, science now tells us, our whole world and all it contains are composed.

### A New Weapon

WITHIN a short time there will arrive in the United States from Denmark a supply of a chemical preparation that may prove to be one of the most important contributions ever made to the science of medicine. It is a treatment for tuberculosis, developed by Dr. Holger Mollgaard, professor of physiology at the Agricultural College of Copenhagen, which is said to have been employed successfully in clinical use by its discoverer.

It is for the purpose of permitting the United States Public Health Service to subject the compound—called "sanocrysin"—to thorough test that a supply of it is being shipped to this country.

The preparation is a solution of a double salt of gold and sodium with thiosulphuric acid. The treatment consists of injecting the preparation into the veins or muscles. It is said to penetrate animal tissues quickly, thus reaching the tubercular clusters rapidly, and to act on the bacilli with sudden and deadly effect. Its destructive powers are said to be so rapid, in fact, that this in itself offers a danger to the patient, for the poisons from myriads of dead tubercle bacilli piling up in the system constitute a deadly menace. To counteract this toxic effect, however, a serum has been devised, which is reported to be entirely efficacious.

Reports from Denmark assert that "hundreds of cases have been treated successfully in Copenhagen hospitals, some of them being persons in the advanced stages of the disease." Dr. Allen W. Freeman, of Johns Hopkins Hospital, who visited Copenhagen recently, has reported to the annual conference of Ohio Health Commissioners that he observed the treatment being used with apparent success.

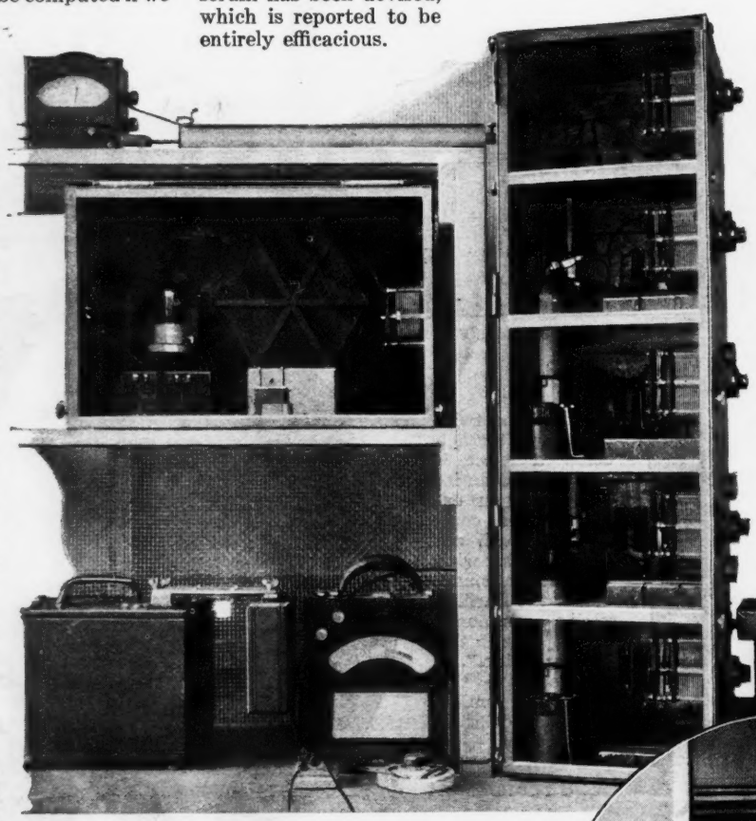
However, conservative physicians, mindful of the failure of other loudly heralded medical discoveries, are seeking to prevent the hopes of tuberculosis sufferers from being raised too high until the new treatment has proved itself.

### Other Universes like Ours

HERE and there in the sky are hazy patches of light, which astronomers call "spiral nebulae." Just what they are, astronomers never have agreed, some holding that they are other faraway "universes" or stellar systems like the one of which our earth is a part, while others have contended that they are within our universe, about as far distant from us as our faintest stars.

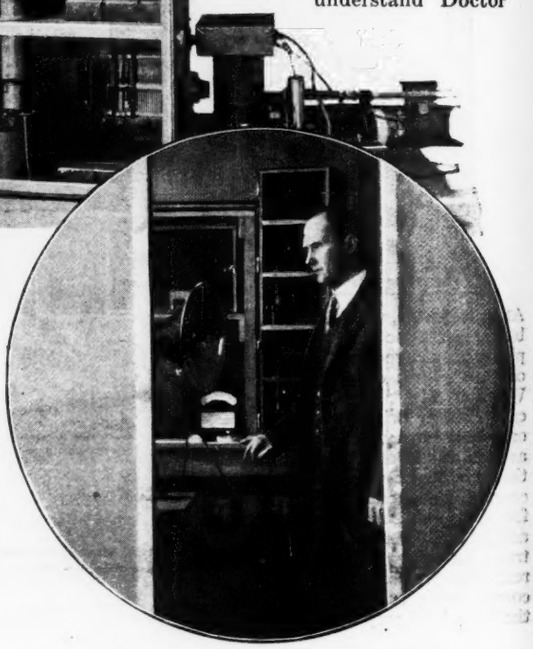
A discovery in support of the first theory was made recently by Dr. Edwin Hubble, of the Mt. Wilson Observatory in California, who announces that his investigations show the spiral nebulae actually to be independent universes — suns, stars, and planets such as those of our universe—and six quintillion (6,000,000,000,000,000,000) miles or more away from us.

Such figures mean little to us. We can, though, understand Doctor



**Amplifier Magnifies Sounds a Million Times**

With this vacuum-tube amplifying apparatus, Dr. A. W. Hull, of the General Electric Company, and Dr. N. H. Williams, of the University of Michigan, listen to the noise of electrons as they bombard a vacuum-tube plate



Doctor Williams before the loudspeaker, listening to the sounds made by the smallest known particles

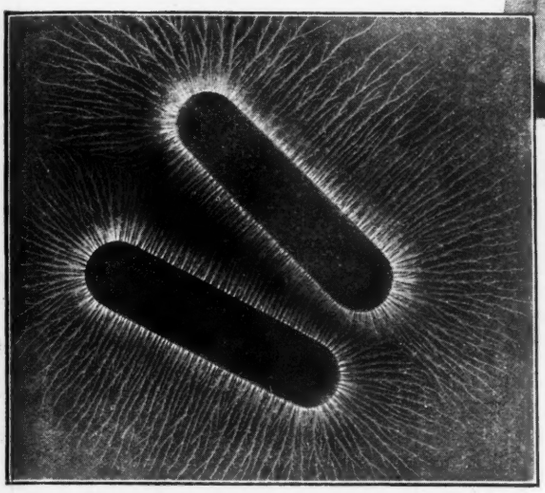
Hubble when he says that the light from the spiral nebulae, traveling 186,000 miles a second, takes one million years to reach the earth! In other words, his computations were based on light waves that started toward the earth a million years before his telescope was mounted, and have just now reached here.

He does not say, however, that these inconceivably distant objects mark the limits of space. Other galaxies of stars—other universes—probably are still more remote, he says, and appear smaller in consequence.

## Smallest Time Measurement

SPLITTING seconds into a billion parts was the amazing accomplishment announced recently by Prof. Paul Heymans, professor of theoretical physics at the Massachusetts Institute of Technology.

After a gasp of astonishment that any one could make a measurement so minute, the natural question occurs: What of it?

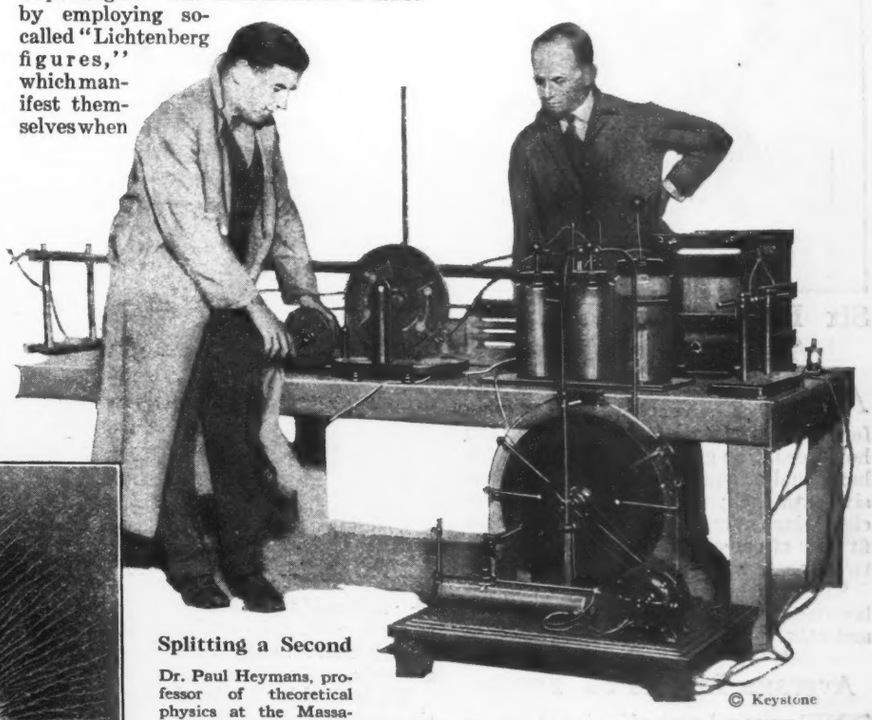


What use shall we ever have for a method of measuring a billionth of a second, or one-hundredth of one-billionth of a second, as Professor Heymans thinks we may detect soon?

One of the possible uses might be to determine the difference in time it would take for two bodies of the same shape, but of different materials, to fall from the same height.

This would throw tremendous light upon our knowledge of what is inside the earth. For a long time geologists have based their theories on the assumption that all materials fall to the ground from the same height in the same time. But by means of the new instrument, it may be learned that the force of gravity varies in different substances. If it is true that the gravity pull in the earth varies toward different objects, this knowledge would be tremendously important in determining conditions in the interior of the earth, and might prove of great consequence in studies of earthquakes and eruptions.

Another application of the time-splitting device might be to determine in which mediums electricity travels fastest. This would be valuable in designing X-ray tubes where the velocity of electricity must be introduced to make a correct design. Studies might be made, too, of the actual mechanism of the conduction of electricity through solutions. This would prove of immense importance in the electrochemical and electroplating industries. This remarkable apparatus is a modification of one devised by Professor P. O. Pederson at the University of Copenhagen. The measurement is made by employing so-called "Lichtenberg figures," which manifest themselves when an electric wave is reflected from an electrode. When two electrodes are placed side by side at a certain angle and distance, the Lichtenberg figures meet. The position of the meeting line depends upon the time that has elapsed between the times that the electric waves reach the electrodes. The rate at which these figures are formed is so extremely large that intervals of time from one-thousandth of one-billionth of a second may be detected.



**Splitting a Second**

Dr. Paul Heymans, professor of theoretical physics at the Massachusetts Institute of Technology (left) and his assistant, Nathaniel H. Frank, working at the laboratory apparatus with which they have succeeded in splitting a second into a billion parts. The measurements are made by means of so-called "Lichtenberg figures," shown in the photograph at the left, which are produced when an electric wave is reflected from an electrode by laboratory methods

© Keystone

## A Radio Compass for Flyers

ANOTHER forward step in commercial aviation was taken a few weeks ago when Lieut. George W. Goddard flew in an army plane from Dayton, Ohio, to Moundsville, W. Va., through virtually continuous haze, guided entirely by radio compass, steering only in response to signals from transmitting stations at his starting place and destination.

The radio compass for aircraft was perfected by the Army Air Service and the Signal Corps. The pilot wears a close-fitting helmet equipped with ear phones, and his hearing of the signals is facilitated by long exhaust pipes that carry away the sound of the motor explosions. A 300-foot weighted wire, suspended from the plane, serves as an aerial, and the receiving set is "grounded" on the body of the plane. While the pilot remains on his course, he hears only a constant string of "dashes" from his radio receiver. Should he veer to the left, he is warned by hearing a "dash" followed by a "dot" every 10 seconds. If he goes off course to the right, he hears "dots" followed by "dashes."

Lieutenant Goddard's flight was made on a direct beeline and in exceptionally fast time.

## Drops of Electric Fire

GLOWING, golden droplets of liquid fire, a new and spectacular type of electrical discharge, were discovered recently by Dr. Irving Langmuir, C. G. Found, and A. F. Dittmer of the research laboratory of the General Electric Company at Schenectady, N.Y. This phenomenon is expected to lead to a better understanding of what takes place in a vacuum.

The globules were observed when a trace of tungsten was introduced in a discharge tube filled with argon. They seem to have characteristics similar to those of ball lightning, to which so many peculiar antics have been attributed. The nature of the globules in this experiment, therefore, has led scientists to conclude that in the strange ball lightning there is an outer surface of positive electric charges within which are imprisoned negatively charged incandescent particles of matter.

The tube used in the experiment has a tungsten filament at one end, heated to a glow by low voltage. High voltage between the filament and a small plate electrode at the other end of the tube completes the circuit. Pure argon, an inert gas, is sealed in the tube at low pressure.

By altering the current passing through the tube, tiny particles of the tungsten filament are made to "sputter" into the argon vapor. This small amount of tungsten emitted produces an astonishing effect. When a magnet is brought near, droplets are formed. The size of these can be varied from the tiniest of drops to the size of a pea.

# Better Tools and New

## Six Handy End Wrenches Assembled on Ring

A SET of six very serviceable end wrenches assembled on one ring forms a useful tool for work about the house or in the garage. The smallest fits hexagonal or square nuts measuring five-sixteenth inch; the largest is for five-eighth-inch nuts, while the other wrenches fit nuts of one-eighth-inch gradations between these two measurements.

The wrenches are handy for the car, the lawnmower, vacuum cleaner, radio work, and other purposes.

## Average Life Is 56 Years

THE average length of life in the United States now is 56 years, an increase of 15 years since 1870, according to a recent report of the U. S. Public Health Service. In the sixteenth century human life averaged only between 18 and 20 years.

## A Portable Soldering Outfit for Linemen

How a lineman carries the portable soldering outfit on his back while climbing a pole

THIS portable, compact soldering outfit is said to enable telephone linemen to accomplish more work in a day and do it with more safety than by the older methods.

While climbing a pole, the lineman carries a tank of acetylene gas, a soldering iron, and torch attachments, all strapped to his back and out of his way. The outfit may be used for overhead line, or underground cable jobs.

The flame is easily controlled and not affected by the weather, a valuable feature for linemen, whose most important work is often done in the worst weather, as thunderstorms and snowstorms are the worst enemies of telegraph poles and lines.

## Newest Rope Fire Escape Has Safety Control

HERE is a new safety fire-escape device, consisting of a rope fitted with combination slide and clamping castings.

In case of fire, the person trapped in a burning building uncoils the escape rope, and slides the casting along the rope so that it rests just below the window-sill.

A loop of rope fits around a person's body under the arms. Sliding down the rope, he governs his speed by manipulating a brake-control wheel on the slide with his right hand, while grasping the body of the casting with his left.

## Automatic Signal Replaces Traffic Cop

BLOOMFIELD, N. J., is cutting down its police force by installing electrical automatic traffic signals. The "stop" and "go" signs revolve at regular intervals, which can be shortened or lengthened to meet the requirements of any particular crossing.

The old and the new in traffic regulation—a uniformed traffic cop standing beside the new automatic "stop" and "go" signal

Tests have shown, it is said, that the signs will operate successfully and that they are sufficient warning for automobile drivers to know when they are supposed to halt. It remains to be seen, however, whether mechanical traffic officers of this kind will command the same obedience that a policeman will.

## Coastguardsmen Rescued 2462 Persons in Year

THE army of thousands of men of the U. S. Coastguard Service, who patrol our 13,000 miles of coastline as methodically as a ship's deck, constitute the most complete life-saving organization in the world. During the 12 months ending last July 1 men from coastguard boats and stations rescued 2462 persons from positions of peril. There was never a day in the year in which guardsmen did not perform some service to vessels or persons in distress.

Scattered along our coasts are hundreds of stations, fleets of boats, and wrecking machinery units, linked by telephones and by the new radio receiving and broadcasting stations. This vast machinery can be set in operation a few minutes after a distress signal is picked up from a ship at sea, and in this way any emergency can be met.

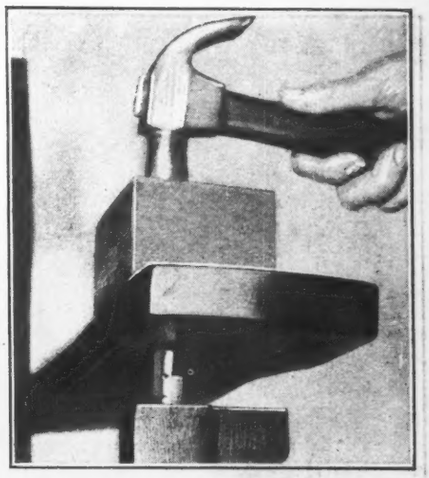
# Labor-Saving Methods

## Fighting Perilous Mine Dust with Cannon

SHOOTING at dust with a cannon is a new and strange method by which the Federal Bureau of Mines expects to reduce the annual appalling death toll in mines caused by the many coal-dust explosions.

The dust cannon is mounted on a mine car and moved quickly to any part of a mine where danger is believed to be imminent. The gunner fires a charge of black powder, sending the dust, if there is any, spraying in all directions.

The seriousness of the inflammable dust menace is being realized more and more, and the government is experimenting with many devices to fight it. The dust cannon shown in the photograph is considered especially practical because of its compactness and the ease with which it can be moved.

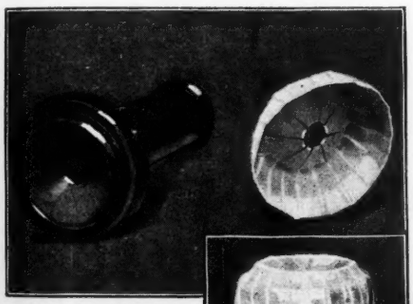


## A Simple and Easy Way to Mend Shaky Chairs

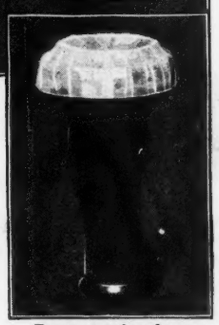
FIRST aid to shaky furniture comes in the form of small pen-shaped metal pieces that fix loose chair parts permanently and without nails or glue. The metal piece is inserted in the rung or loose arm piece, and driven in as shown in the illustration.

## Cheer for the Low-Brows

IF YOU have a low brow, it is no sign that you are less intelligent than a person with a high brow, according to Dr. Ales Hrdlicka, curator of physical anthropology at the National Museum, Washington, D. C.



Protector removed



Protector in place

## A Sanitary Earpiece

THE principle of the sanitary paper drinking cup has been applied to the telephone receiver by José A. Dominguez of Mayaguez, Porto Rico. The device, a sanitary ear protector for radio as well as telephone receivers, is cup-shaped, of strong paraffined paper crimped and pressed so that it will fit easily over the end of the receiver and stay in place without further attention.

Since the cost of each protector is exceedingly small, the inventor proposes that they be installed in public telephone booths and each used only once. Thus every user would be assured of a fresh and sanitary receiving earpiece.

After each telephone call, the old protector would be thrown away and a new one put on by each subscriber.

## New Office Desk Built on Sectional Plan

BUILDING your own desk to fit your own particular needs has been made possible by the recent invention of a sectional desk designed on much the same principle as the sectional bookcase. The units are manufactured in standardized dimensions so that filing cabinets and drawers of specified sizes can be installed as desired.

The foundation units of the desk are two low stools with four legs each. On the flat tops of the stools are placed the side cabinets and drawers, which are held firmly together by means of locking pins. On the cabinets rest the flat desk top, under the center of which is attached a shallow drawer for writing utensils and other small articles.

The manufacturers claim that the units, when assembled, provide a substantial and durable desk for office use.

How the sectional office desk is assembled. Notice how the side cabinets rest on low, four-legged stools, and in turn support the flat top of the desk

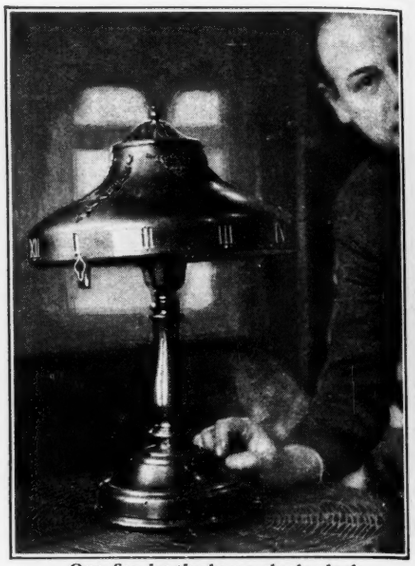
# Novel Appliances

## Revolving Lamp-Shade Tells the Time—

SOME can tell time during the day by looking at the sun. Now, by means of a curious new invention, any one can tell time at night by looking at a lamp. It is a special sort of table lamp, with a shade that is turned by clock works contained in the base of the lamp. The shade makes one complete turn in 12 hours.

A pointer at the edge of the shade indicates the time as marked by perforated figures and dots on the shade. These are not conspicuous and at first glance a visitor would not suspect the double function of the attractive bronze-finished lamp.

This novel lamp-clock has a 21-day movement. A key for winding it is under the lamp base. It will be observed that the photograph was taken at 1.05 o'clock.



One-five by the lamp-shade clock

THE world's record for bricklaying is claimed by a foreman bricklayer of Sheffield, England, who recently laid 809 bricks in an hour, or more than 13 a minute.

### New Split Cane Rod for Deep-Sea Fishing

EIGHTEEN months are required to construct the newest type of deep-sea fishing-rod, designed by an English manufacturer especially for landing big game fish. It is known as a "split cane rod," and is equipped with an enormous brake reel fitted with a brake band not unlike that of an automobile. The brake is operated by a lever.

The rod has a core of highly tempered steel surrounded by two or three layers of cane strips. A cork handle is provided for a better hold.

### An Adjustable Desk Chair

AN OFFICE chair with adjustable back rest and narrow seat has been designed recently to enable desk workers to sit with correct posture and less fatigue. The chair automatically swivels to fit into the hollow of the back where support is needed. Each chair may be adjusted to suit the user.

## Complete Kitchenette in a Small Cabinet

AN ENTIRE kitchenette in what appears to be a refrigerator is a new convenience for those who happen to live in one or two rooms, but cling to their liking for home cooking.

A table providing room for three persons can be attached to one side of the cabinet, so that a meal can be served easily. An ironing-board, too, hangs on the back of the kitchenette.

Either electric stove or gas plate may be used for cooking. If electricity is used, opening the lid automatically connects the electric current, and closing the lid shuts it off. The stove is in a compartment at the top of the cabinet, while in the lower compartments are shelves to hold large cooking utensils and food containers.

Finished in wood tones or white enamel this compact outfit occupies about the same space as an ordinary easy chair.

On the inside of the front door hang other utensils: a rack for dish towels, and a small shelf for milk and cream bottles. This door is hinged in the center so that when it is opened it swings outward, providing convenient access to the articles on the back of it.

These two photographs show clearly how the compact kitchenette appears when opened for use and when closed into a neat cabinet that occupies very small space in an apartment. Notice the cozy folding dining-table hinged to one side of the cabinet; also the compact stove compartment at the top of the open cabinet

# for Every-Day Use

## Self-Standing Golf Bag Replaces Caddy

How the golf bag supports itself

TO ELIMINATE the bother of constantly picking up a golf bag after the completion of each stroke, when the caddy is not on duty, Robert L. Fargo, of Chicago, Ill., has invented a self-standing golf bag.

Two legs attached to the top of the bag are so arranged that they will swing out into place when the bag is tipped. Acting like the legs of a tripod, they hold the bag in a slanting position, keeping the clubs within easy reach and saving wear on the bag.

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A CHEMICAL product resembling glass and useful for many of the same purposes recently was perfected by Fritz Pollak, a German inventor. It can be rolled, bored, polished or cut, without the tendency of glass to splinter. Because of this quality it is useful especially for automobile windows, optical instruments, ornaments, and toilet articles. The inventor arrived at this product by condensing carbamide and theo-carbamide with formaldehyde.

## "Help Yourself" Service for Soft Drinks

OBSERVING the general popularity of "wait-on-yourself" devices in use in the larger cities, a New York inventor has produced a container for iced bottled soft drinks, from which the customer can choose for himself his favorite brand. He opens a lid at the top of the beverage dispenser, then turns a handle, which revolves a tray inside, until the desired bottle is reached.

There is a bottle opener at the side of the dispenser. When the customer has opened the bottle and consumed its contents, he places the empty bottle in a compartment at the bottom of the dispenser, and pays the cashier his reckoning.

Besides giving more efficient service, it is claimed that this method of self-service lowers expenses for labor and cuts the cost of ice bills.

No attendant is required to dispense soft drinks, where this self-service apparatus is installed

## New Needle-Guiding Button

A NEEDLE-FINDING button is a recent invention designed to make sewing on buttons less tiresome. The new button is said to save the worker's time by encouraging the needle to slide easily into the thread holes.

The under side of the button is molded in such a way that wide-mouthed channels guide the needle toward the holes. Instead of having perpendicular sides, the perforations are funnel-shaped with smooth and sloping sides, so that the needle glides readily into the proper place without hitch or hesitation. The arrangement of the holes also distributes the stitches over a wide area of cloth.

A cupped portion on the rear or cloth side receives the mass of thread that it is customary to wrap around the stitches passing through the holes. This makes it possible for the button to lie flat against the surface of the garment.

## A Compact Electric Motor for the Phonograph

THIS new electric phonograph motor recently perfected is said to be the first of its kind that runs without belt, gear, or friction disk reduction. It has a direct drive and will run at a constant speed at the low rate of 40 revolutions a minute. Its maximum speed is 150 revolutions a minute.

The motor is very compact, small enough to be put into a portable phonograph outfit and powerful enough to run the largest phonograph. It operates on any 110-volt circuit.

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## An Auto-Cleaning Sponge that Stays Wet

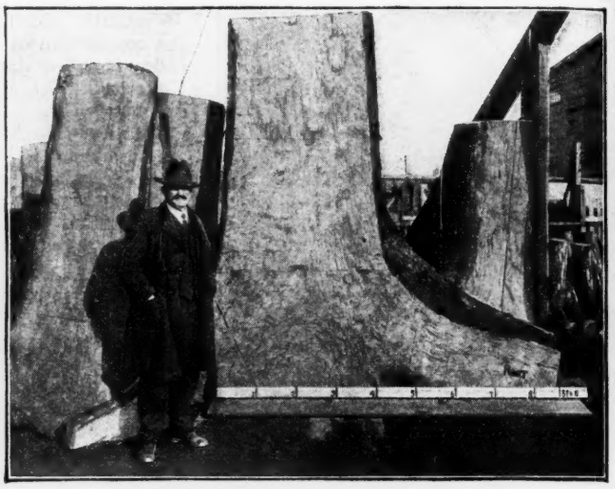
A RUBBER sponge, kept wet by running water, is a new time-saving invention for cleaning an automobile. A rubber tubing is fastened to the sponge through a hollow handle and the other end of the tubing is attached to a faucet or garden hose. A small stream of water is sufficient to keep the sponge moist.

# Oddities Picked up

## Ukelele in Cane—Lifeboat on Wheels—

### Cane-Ukelele

A walking-stick that can be converted instantly into a ukelele is the work of Morris Rothman, of Bayonne, N. J., shown with his invention at left and below



### Ship Knees from Giant Roots

One of the oldest of crafts is that of digging ship knees—the wooden supports formed from giant roots, that are used in constructing the stem and stern of a wooden ship. The photograph shows the largest ship knee ever dug, eight feet eight inches thick at base. It came from a Pacific Coast fir-tree

### Old Railway Caboose a Monument

A railway caboose makes a strange monument, yet this one undoubtedly deserves such an honor; for in it, 41 years ago, was founded the Brotherhood of Railway Trainmen. The historic car was placed recently in an artistic concrete and tile pagoda in Neahwa Park, Oneonta, N. Y.

### Lifeboat on Wheels Launches Itself

This self-launching lifeboat was the center of interest during recent tests at Cleethorpe, England. The motor that drives the propeller also drives the self-launching mechanism which consists of a pair of wheels beneath the hull. The boat is 40 feet long

### Colonial Hammer

This quaint cobbler's hammer was used to repair shoes of Washington's soldiers at Valley Forge

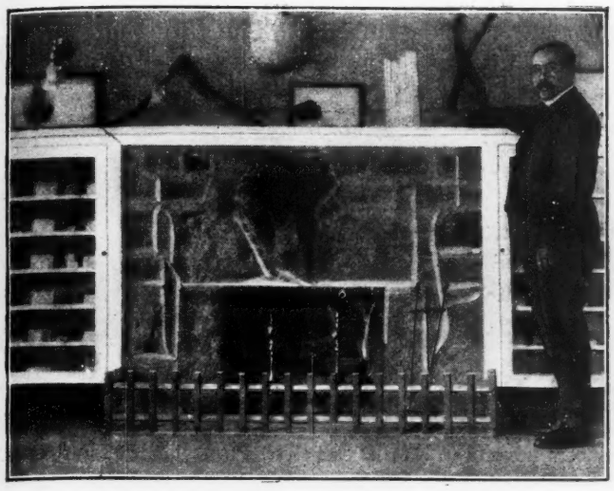
© Keystone

### Operating on a Horse

An interested audience of veterinarians and farmers is shown at the right witnessing a demonstration operation at Purdue University, Indiana. The patient is a horse suffering from the poll-evil, a disease that necessitates a difficult operation. The animal is strapped and chained to the operating table. Horses that once had to be shot now find their way to hospitals where they often are cured and saved for more years of service

# by the Camera Man

## Left-Handed Watch—Fireplace of Jewels

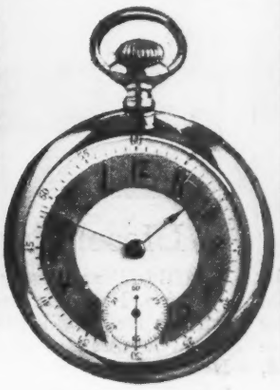


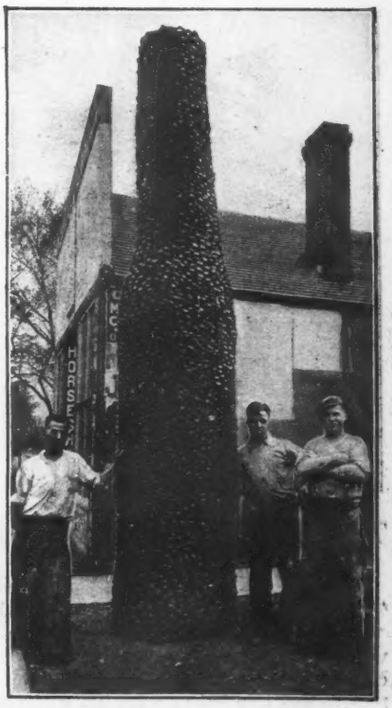
### A Fireplace Studded with Gems

Twenty-six different kinds of precious gems and metals are in the stones of a fireplace in the home of M. A. Barr, at Valley Forge, Pa. The central piece is a solid 300-pound lump of jasper. The stones were found recently on the farm of Mr. Barr, who is seen in the picture

### Runs Backward

A left-handed watch that runs backward is the work of Richard F. Mason, who is a jeweler of Columbus, Ohio



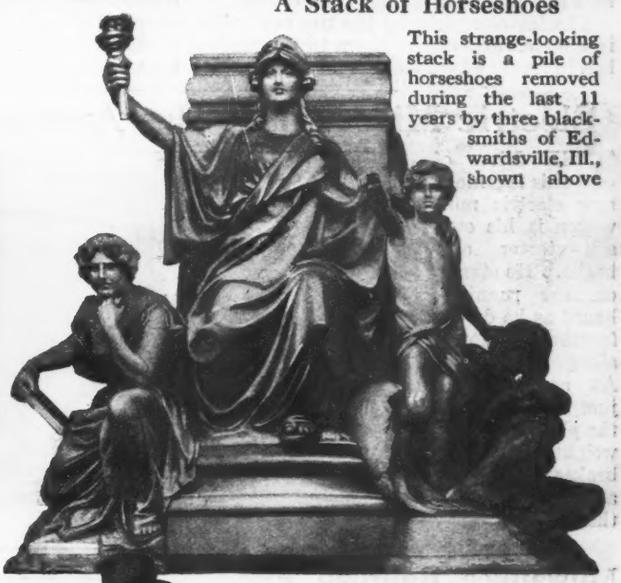


### A Stack of Horseshoes

This strange-looking stack is a pile of horseshoes removed during the last 11 years by three blacksmiths of Edwardsville, Ill., shown above

### China Has a Bridge of Porcelain

One of the world's most unusual bridges, near Peking, China, is made entirely of porcelain, each piece of which has been carefully hand modeled—a fact that goes far to explain its artistic lines and beautiful curves



### "Science" in Sculpture

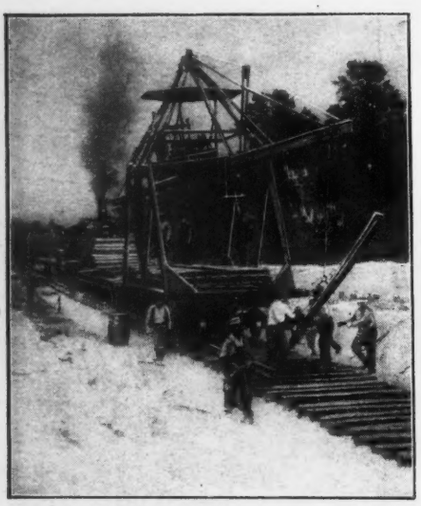
At the foot of a great statue of Christopher Columbus, made by Arnaldo Zocchi for the Argentine government, is this group depicting "Science." The central figure holds a lamp, depicting the search of scientists for hidden truth

### Cattle Cleaner

Show cattle always receive exceptional care. But it has remained for an Iowa cattleman to employ scientific dry cleaning on his animals. Before any of his herd enter a show or sales ring, the vacuum cleaner removes every speck of dust from their shining bodies

# Ten Ingenious New

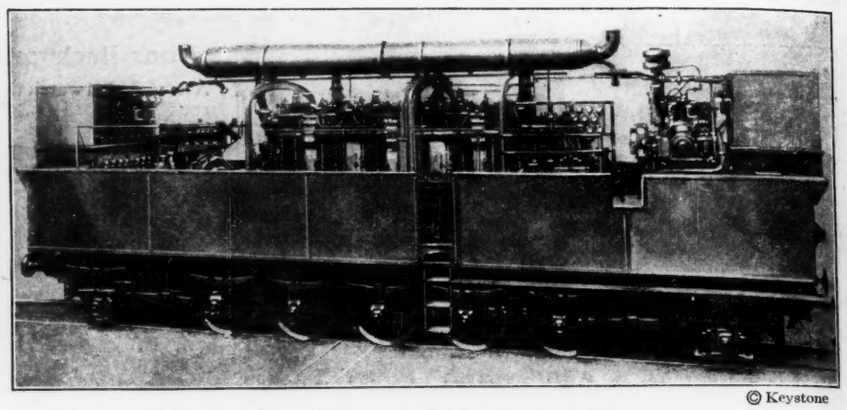
## Unusual Machines and Engines Built



### Track-Laying Machine Aids in Railroad Building

THE size of railway gangs is said to be greatly reduced in southern Florida, where a contractor is employing a new construction outfit consisting of a locomotive and two flat cars loaded with ties, rails and a gas-driven traveling crane.

The traveler picks up the ties and rails in bunches and carries them to the roadbed in front, where workmen lay them.



© Keystone

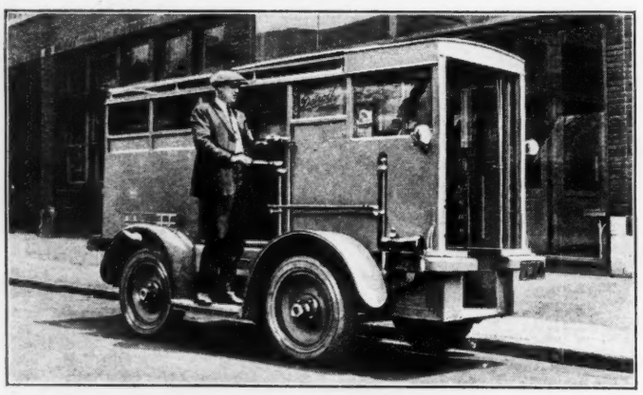
### Diesel Engine Runs Electric Locomotive

DUE to the necessity for coal conservation, European engineers have been striving for an efficient locomotive that would be run by other means than steam. Here is shown one of the newest designs, a Diesel electric locomotive built in Germany for negotiating more quickly and economically the vast stretches of territory on the Russian steppes.

The locomotive is equipped with powerful Diesel oil engines, which generate electric current to drive the locomotive. This transforms a railroad into an electric line.

### Electric Milk Truck Has Automatic Brakes

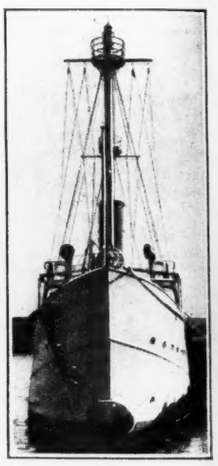
THE driver of this ingenious new electric milk wagon is his own self-starter and brake. He stands on the running-board as he drives from house to house along his route. As soon as he jumps off, freeing the platform of his weight, hydraulic brakes are applied automatically to the car.



### New Type of Lightship for New York Harbor

THE last word in lightships is the *Five-Fathom Light*, designed for duty off New York Harbor. Two mast lights will flash each night and powerful radio equipment will assist in protection of the great harbor's shipping.

This latest of Uncle Sam's coastal safeguards has a gross tonnage of 825, is 146 feet long, and has oil-burning engines.



### Milwaukee Railroad Plans to Electrify System

PLANS for electrifying the entire system of the Chicago, Milwaukee & St. Paul Railway, operating lines throughout the West are being formulated by officials of the road, according to recent reports. The Milwaukee already operates 660 miles of electrified road over the Cascades and Rocky Mountains.

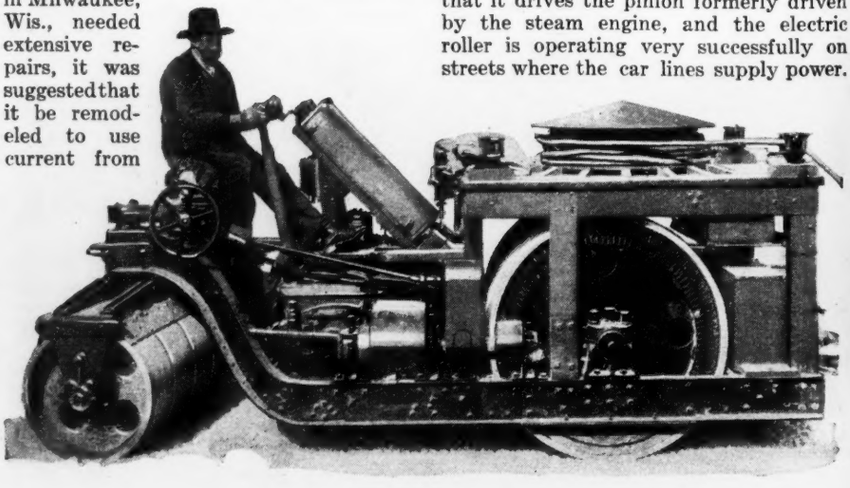
The vast new project is said to have had its origin in an offer by Henry Ford to supply power for the railway system from his hydraulic plant which is being completed on the banks of the Mississippi River at Minneapolis. To this plant the railroad has constructed a bridge across the Mississippi at a cost of $3,000,000, and plans to handle the freight from Fords' accessory plants operated in connection with the electric power plant.

All terminal switching will be done by electric power when the project is completed.

### Electricity Replaces Steam in Road Roller

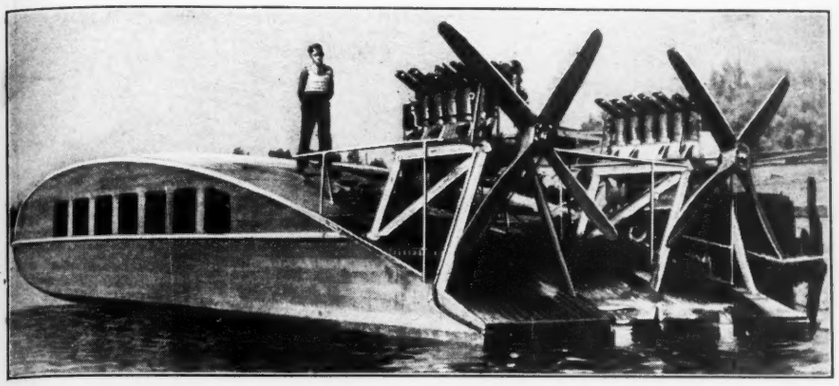
WHEN a steam roller belonging to an electric railway and light company in Milwaukee, Wis., needed extensive repairs, it was suggested that it be remodeled to use current from trolley circuits operated by the firm.

The electric motor was mounted so that it drives the pinion formerly driven by the steam engine, and the electric roller is operating very successfully on streets where the car lines supply power.



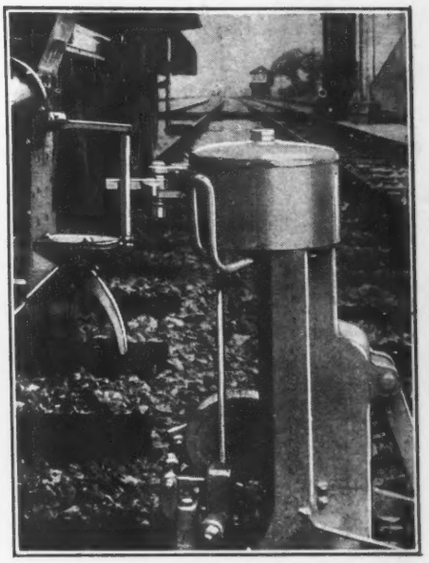
# Products of Mechanics

## to Increase Our Every-Day Efficiency



## Twin Motors Drive Streamlined Hydroplane

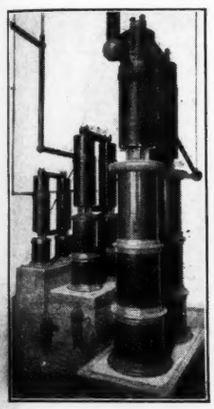
THIS strange craft, shown lying at anchor on the Danube River, is a giant hydroplane of unusual design recently built in Vienna, Austria, for W. D. McDaniel, an American. It is run by two giant six-cylinder motors driving four-bladed propellers. It is said to be capable of developing 160 horsepower and very great speed. By having a streamlined body and shallow draft, wind and water resistance are reduced to a minimum. A roomy passenger cabin is provided behind the sloping bow of the craft.



## Safety Stop Sets Engine's Brakes Automatically

THE automatic train stop pictured above, designed to prevent collisions, is the recent invention of British railway engineers. A projecting arm from a device at the side of the track strikes a prop held between two metal arms projecting from the locomotive. The upper arm drops, setting the air brakes of the locomotive.

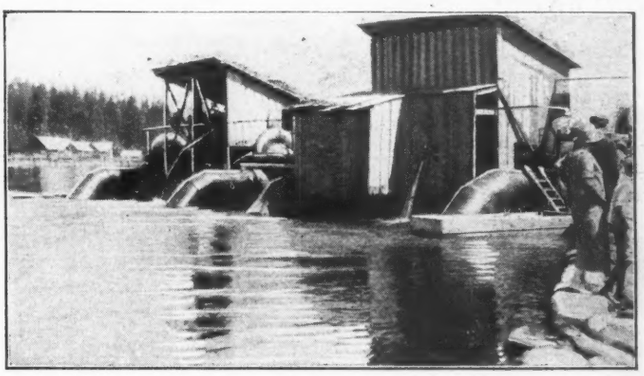
## Huge Transformers Built to Test Insulators



THESE three huge step-up transformers, capable of producing electrical tensions of more than a million volts, are part of the equipment of an enormous new all-metal electrical laboratory recently completed by the Compagnie Générale d'Electro Céramique at Ivry, France.

The laboratory was built to test electrical apparatus designed to withstand high voltages, particularly porcelain insulators. Note size of transformers compared with the men.

## Pumps Pour Lake Water into Dry River-Bed



IN WESTERN Nevada, engineers, by means of five gigantic pumps, recently supplied a dry river-bed with water, thus providing for the irrigation of 12,000 acres of land and saving crops valued at more than $200,000.

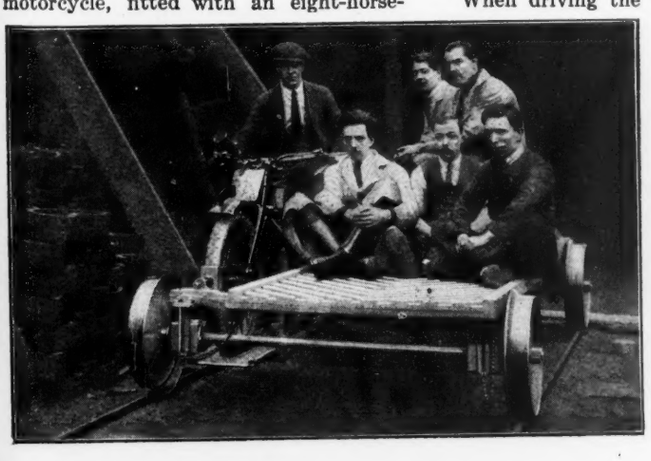
The pumps were installed when the level of scenic Lake Tahoe sank so low that the natural overflow of water into the Truckee River stopped entirely. They were set about 300 feet out in the lake, in three feet of water, and have kept a continual swirl of water going over the lake rim into the dry river-bed, pumping from 115,000 to 120,000 gallons of water a minute.

Since they were placed in operation, the pumps have lowered the level of the lake more than two feet.

## Odd Railway Car Propelled by Motorcycle

A NOVEL railroad inspection car propelled by a motorcycle was constructed recently in India. When the motorcycle, fitted with an eight-horsepower engine, is required for use off the tracks, it can be detached from the truck in a few minutes.

When driving the truck, the cycle is carried on a small platform slightly lower than the truck platform at one side. The wheels rest in cradles shaped to fit the tires. After the cycle is in position, the driving chain is removed from the sprocket on the rear wheel and attached to a sprocket on the truck, and the truck becomes a power car.



## May Revolutionize Motors

A GAS turbine engine that, it is claimed, may revolutionize automobile and airplane motors is being perfected by a French engineer. It is said to combine the advantages of the explosive gas motor and the steam turbine.

Recent tests before officers of the French Air Service, are reported to have given complete satisfaction, the engine turning smoothly at the rate of 1500 revolutions a minute.

# "John," a 150-Pound Dummy, Tests Air-Mail Parachutes

UNDER the fuselage of the airplane shown in the above photograph hangs "John," a 150-pound dummy, who has made more parachute drops than any other member of the government flying personnel. The man-sized dummy is used to test thoroughly scores of parachutes recently purchased for air-mail pilots who must fly often in extremely adverse weather conditions.

Using the Salt Lake City air-mail field as a base of operations, an army plane conducts the tests in which "John" is put through a grueling series of parachute drops. At an altitude of 2500 feet the dummy is cut loose, descending from a unique releasing device under the fuselage. If the parachutes pass the tests with the dummy, they are considered safe.

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A NEW record for slowness in flying was established recently by Captain Leprier, a French naval officer, who piloted a specially designed machine at a speed of only 31¼ miles an hour.

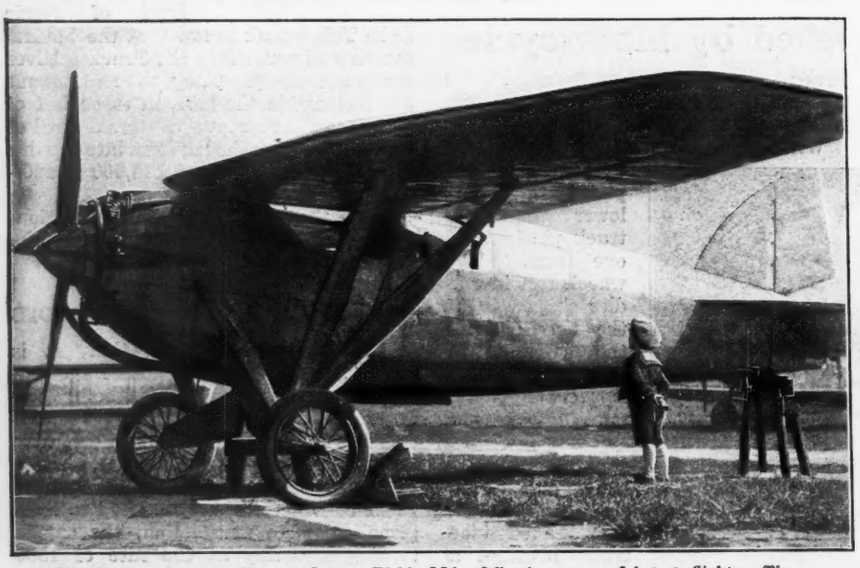
## Smallest Airplane Weighs Only 221 Pounds

HERE is what experts have described as the smallest practical airplane in the world. It is known as the "Hummer" and was flown at a recent air meet recently at Dayton, Ohio, by its builder, Bert Mix, an airplane mechanic.

The "Hummer" weighs only 221 pounds. It has a spread of 12 feet, goes 75 miles an hour and makes about 50 miles to the gallon.

The "Hummer," with its owner and builder, Bert Mix

## Homemade Metal Monoplane with Folding Wings Fits in Garage



The homemade monoplane at Logan Field, Md., following successful test flights. The plane was constructed entirely of duralumin. The wings can be folded for storing the plane

A HOMEMADE all-metal monoplane of duralumin, built in a back yard with comparatively crude tools, can be folded to fit in a garage. The designer, W. H. A. Boyd, of Baltimore, Md., did not know how to fly, nor did his father, W. B. Boyd, nor brother, C. M. Boyd, who helped him build it.

Lieutenant Leo. M. Willinger tried out the plane on Logan Field recently with great success. On two occasions he flew to an altitude of 2500 feet, and made a speed of 90 miles an hour.

Its low horsepower, 40, made rising from the ground difficult, but this is to be remedied by installing a larger motor.

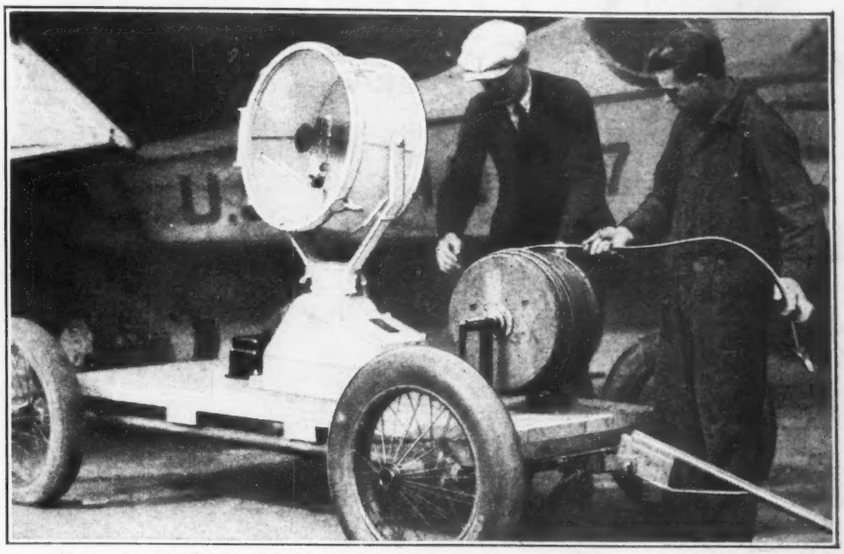
A striking point in the construction of the plane is the absence of bracing wires. Made entirely of duralumin, the plane weighs only 800 pounds and has a wing spread of 30 feet. By removing two pins on each of the wings, they can be folded so that the plane can be stored or shipped easily. When folded, it is only seven feet wide. It can be knocked down in 15 minutes.

# Powerful Portable Searchlights Guide Air-Mail Fliers

TO AID United States air-mail pilots in making night landings, new portable searchlights recently have been installed at Crissy Field, San Francisco. On clear nights, it is said that pilots can see the piercing rays of these 450-million-candlepower lights when they are from 100 to 150 miles distant. The lights have 36-inch lenses.

Since the inauguration of night flying in the mail service, which has meant great economy to business in the United States on account of time saved in correspondence, many types of electric beacons have been tried out, some on high towers. The new portable type is expected to prove especially valuable since it can be moved about on the landing-field under varying conditions to the position most helpful to the landing planes.

To accomplish this, each searchlight is mounted on a wooden platform supported on a low metal frame with four automobile wheels. Hundreds of feet of cable that carries the current from power source to the light is wound on a reel at one end of the truck. This cable is paid out or reeled in as the searchlight is wheeled from one position to another.



The new portable searchlight, showing the reel that carries the electric feed line

In the photograph above are seen two United States air-mail employees testing one of the lights at Crissy Field.

## Air Freighter Carries a 2700-Pound Cargo

AERIAL freighting appears definitely to have outgrown the possibility stage. This sky cargo ship runs regularly between London and Paris, transporting perishable products and goods to fill special orders. It carries a cargo of 2700 pounds, or nearly 1½ tons.

The photograph shows how the airplane freighter is loaded.

## British Government Orders Two Giant Airships

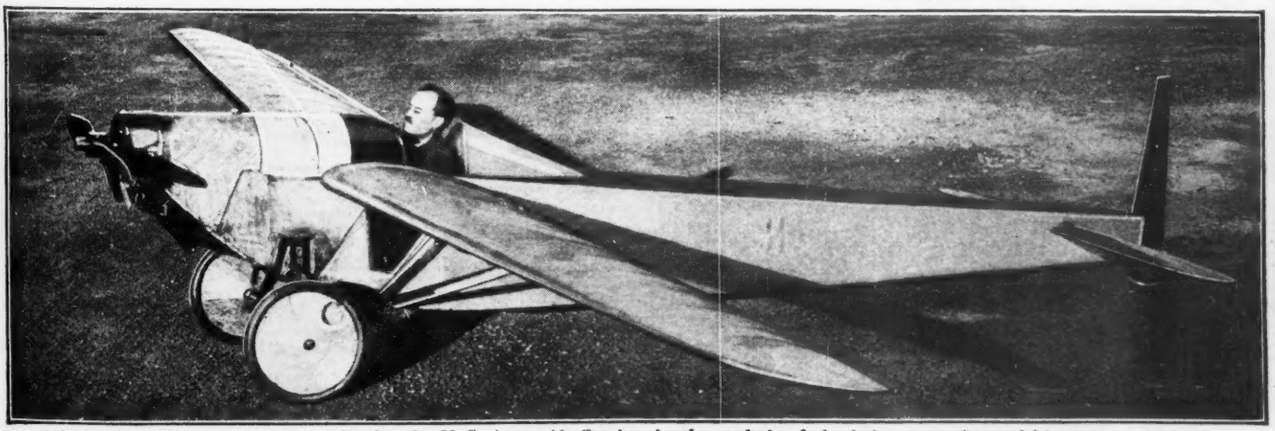
FOLLOWING a recent decision to redevelop airship transportation in England, the British government has just ordered the first of two giant dirigibles, each of 5,000,000 cubic feet capacity, for transportation of passengers and freight. One of the ships, it is understood, will fly on regular schedule from England to Egypt and India.

The cost of the first ship, it is estimated, will be about $1,600,000. Its length will be 695 feet and its greatest diameter 132 feet. The contract specifies that the structure and other fixed weights must not exceed 90 tons. Its range will be 2500 miles, and it will be capable of carrying 120 passengers and 10 tons of freight. Beside 30 two-berth cabins along the sides of the vessel, there will be a smoking-room, a lounge large enough to dance in, a kitchen, and quarters for a crew of 40.

## Aviator Builds Baby Monoplane and Flies to Height of 1800 Feet

A REMARKABLE new type of small, baby monoplane was completed recently by Edward F. Allen, a test pilot of Washington, D. C., who recently attained in it a height of 1800 feet.

Experts believe that one of the next important steps in aviation will be a small, inexpensive plane that can be kept in a garage and flown from a yard. This little plane is a distinct advance toward that goal. It is equipped with a nine-horsepower motorcycle engine and weighs only 205 pounds, with a wing spread of 27 feet. It can make 63 miles an hour.



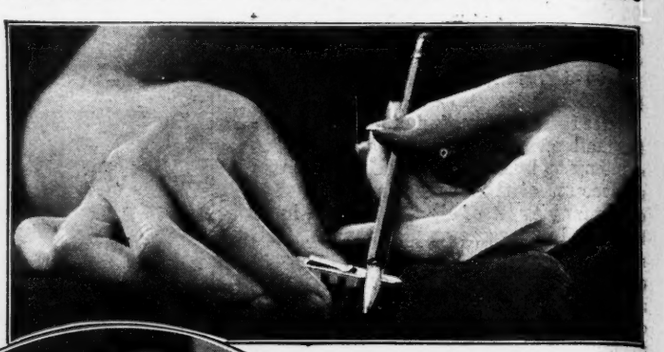
Edward F. Allen, wartime test pilot for the U. S. Army Air Service, in the cockpit of the baby monoplane of his own construction

# A Dozen and One New

## Ingenious Inventions and Automatic Machines

### Seals Letters Automatically

Driven by electricity, this machine stamps and seals letters. The letters are fed in at the left and deposited in the receiving rack



### Pencil Clip Is Knife

A little pocket device that will be found convenient for many office uses serves as a clip to hold the pencil in the pocket, and as a keen two-edged knife for sharpening pencils, cutting string, or erasing ink. It answers the purposes of a pocket-knife besides serving as a pen or lead-pencil clip

### Ten Stamps in One

Ten different stamps of from one, two, three lines each are available in this metal self-inking device

### Phone Lock

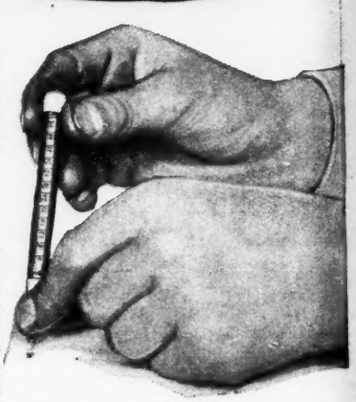
With a padlock holding down the receiver hook, as shown at right, the business man can prevent his telephone from being used in his absence

### Opens Cartons in Three Strokes

Three motions with a new carton cutter open fiber or corrugated pasteboard boxes quickly. A sharp cutting blade projecting from the tool is so shaped that it readily adjusts itself to the edge of the box

### Pencil Calculator

A calculator that can be slipped on any pencil (at right) is operated by twisting a small handle. Results are shown in figures through a slot in a revolving collar

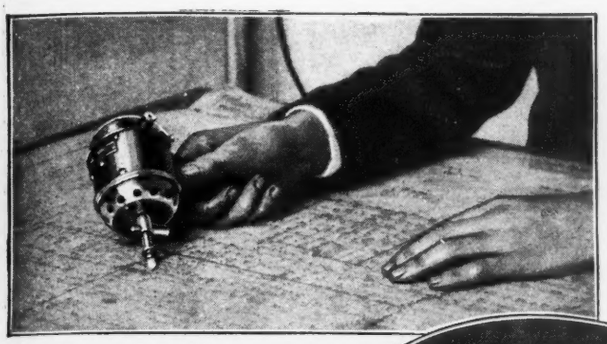


### Typewriter-Punch

By means of electrical connections from the numeral keys of a typewriter to a power punch, the machine at the left enables a typist to punch tabulating cards, thus dispensing with an extra operator for the punch

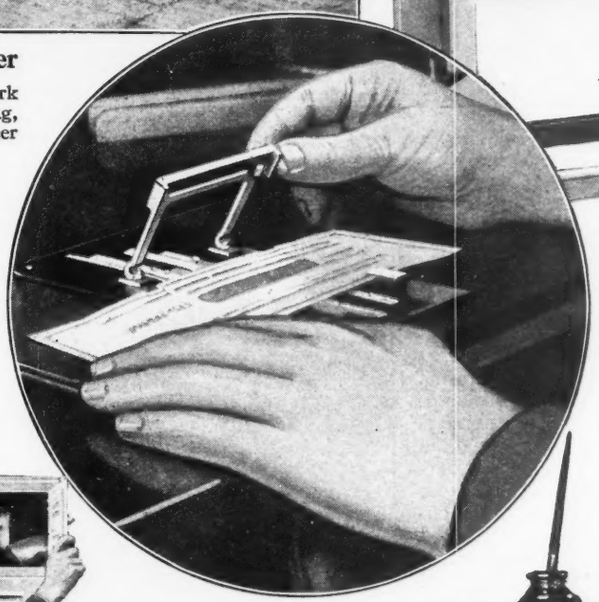
# Ideas for Busy Offices

## Designed to Save Valuable Time and Labor



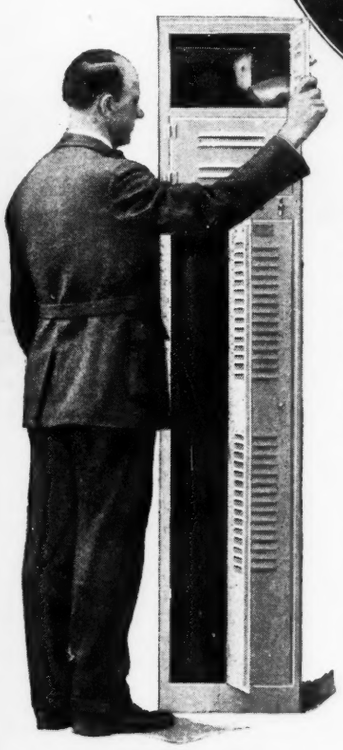
### Motor-Driven Eraser

In drafting or other work that requires much erasing, an electric power eraser will be found convenient. The complete unit, consisting of motor and eraser, weighs less than two pounds. It is said to be able to remove a period without touching surrounding copy. Correct pressure for erasing is obtained without the possibility of rubbing through



### A Compact Posting Desk

For keeping a large number of record cards in a small space, under fire protection, this posting ledger desk recently was designed. It concentrates from 8000 to 15,000 cards within easy reach of one posting clerk. A movable tray that slides on tracks above the card trays provides a handy surface for writing

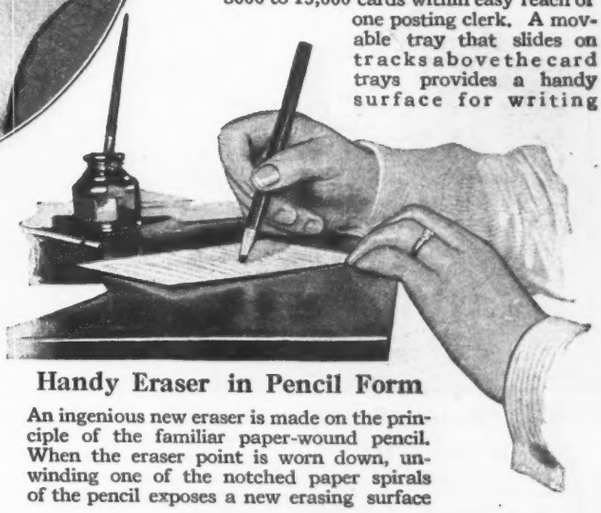


### A Convenient Locker

An economical new type of metal locker is said to provide storage for workers' hats and coats in half the space usually required. A small compartment at the top is for hats and small packages, lunchbox, or a book

### Pocket Check Protector

A checkbook with its own check protector attached inside the cover contains checks that have specially treated, semi-transparent "windows." These are placed over movable rows of raised numerals that can be arranged in the desired combination. A locking device then is lowered on the check and a roller is pushed across the window, making an indelible impression of the amount

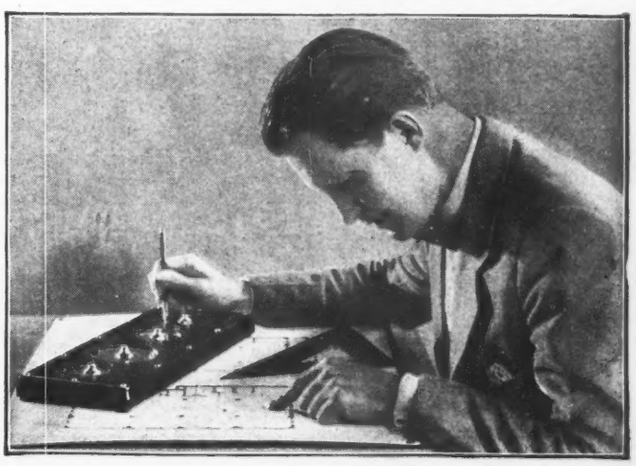


### Handy Eraser in Pencil Form

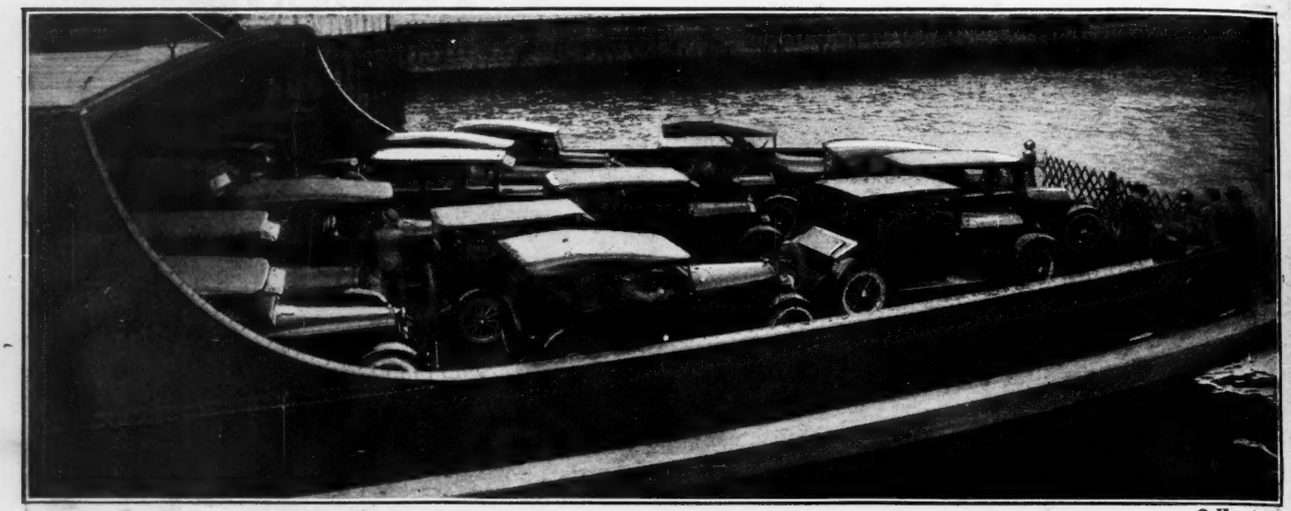
An ingenious new eraser is made on the principle of the familiar paper-wound pencil. When the eraser point is worn down, unwinding one of the notched paper spirals of the pencil exposes a new erasing surface

### For Adding Fractions

The calculating device shown at the right is a fractional adding machine designed for use where fractional numbers are encountered often, as in architectural and engineering work. It adds feet, inches and fractions of inches, always reducing them to their simplest form and with the results instantly visible. The instrument, containing four dials, is operated by the use of a steel stylus



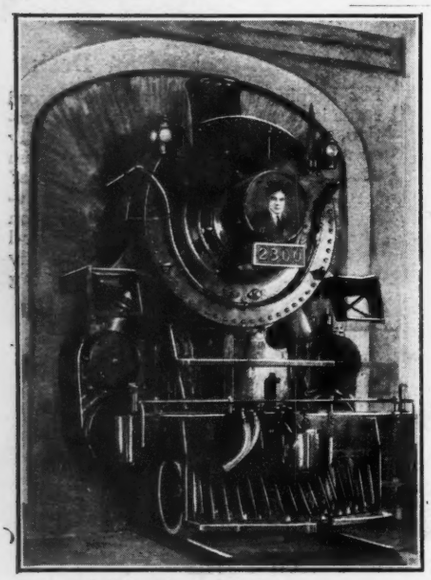
# Automobile Ferries Relieve Traffic Jam on Hudson



© Keystone

UNTIL the vehicular tunnel now under construction under the Hudson River is completed, all automobiles passing between New York and New Jersey have to be carried across the river on ferries. On some days, especially holidays, the line of cars waiting for transportation on the New Jersey side is more than a mile long.

To lessen the traffic congestion and enable automobile commuters to get to work on time, a new type of ferry-boat that carries only automobiles has been put in operation. The photograph shows one of these boats carrying a load of cars.



## Wood Model of Locomotive in Banquet Hall

TO PROVIDE appropriate decoration for a banquet of railroad officials in the Chateau Frontenac at Quebec, Canada, recently, a full size wooden model of a fast passenger locomotive was constructed and set up in the banquet room.

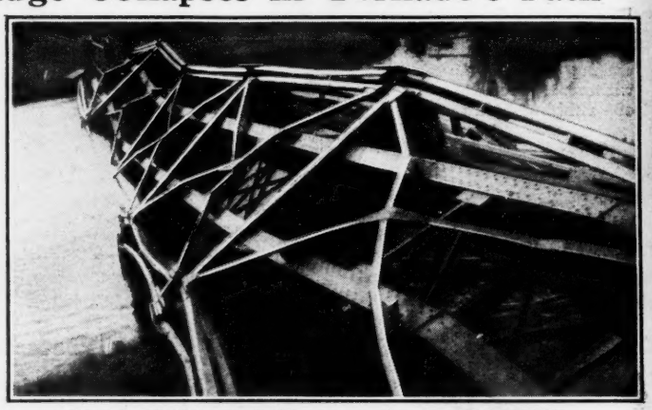
The model represented the locomotive as emerging from the Connaught Tunnel, one of the greatest engineering undertakings on the North American continent. The model was an exact replica in even the smallest particulars.

## Your Questions Answered

AS A special service to readers, the Information Department of POPULAR SCIENCE MONTHLY will answer all reasonable questions on general science, mechanics, and radio. Write your questions as briefly as possible and inclose a self-addressed stamped envelope.

## Steel Bridge Collapses in Tornado's Path

WE MAY boast that we have conquered nature, but when a natural force actually demonstrates its power, we often have to admit ourselves beaten. Near Withee, Wis., engineers constructed a footbridge across a river. Made of steel to withstand fire, the force of the current, and the wear of traffic, it should have lasted for centuries.



Steel footbridge wrecked by a tornado near Withee, Wis.

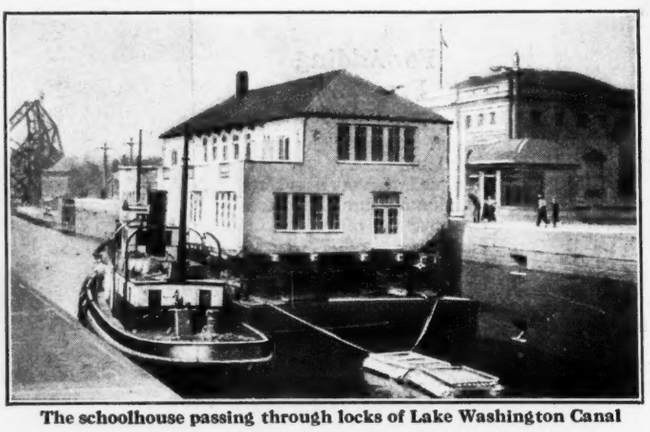
But a tornado came along, and in its path the bridge collapsed as if built of cardboard. Is it any wonder that men today still have the same fear of these terrible windstorms as did the savages of the dark ages?

## Schoolhouse Moved Seven Miles by Water

TAKING a schoolhouse off dry land, floating it through canal locks, and towing it seven miles across Puget Sound to a new location on an island, was the unusual feat accomplished recently by a Seattle firm of contractors.

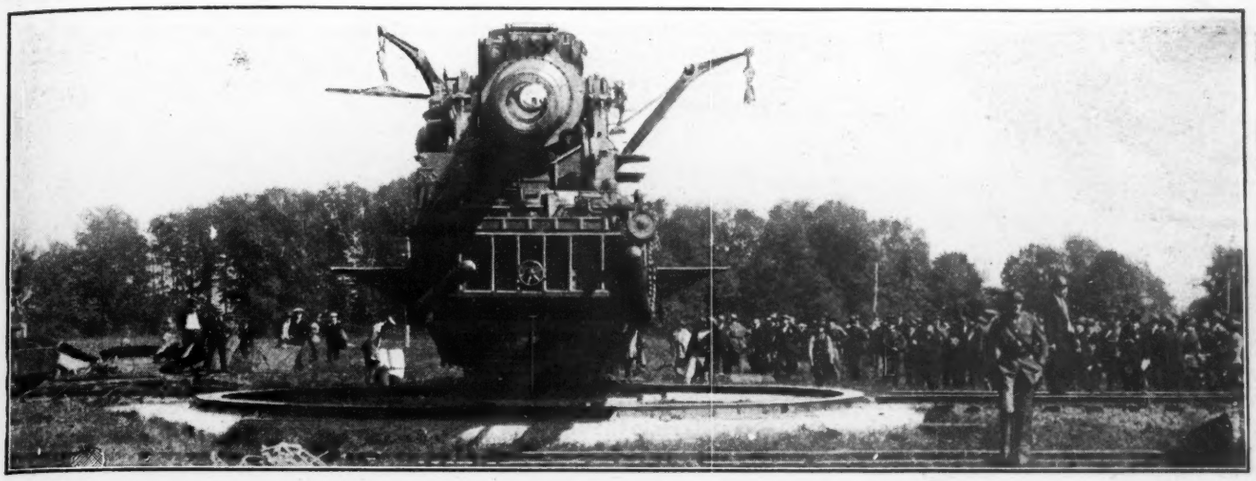
The schoolhouse originally was situated on the shores of Lake Washington, adjoining Seattle. With powerful winches and screwjacks operated simultaneously, the building was raised off the ground and skidded on rollers onto a large barge. Two tugs then towed the school through Lake Washington Canal and the locks shown in the illustration, to Puget Sound.

The school arrived undamaged.



The schoolhouse passing through locks of Lake Washington Canal

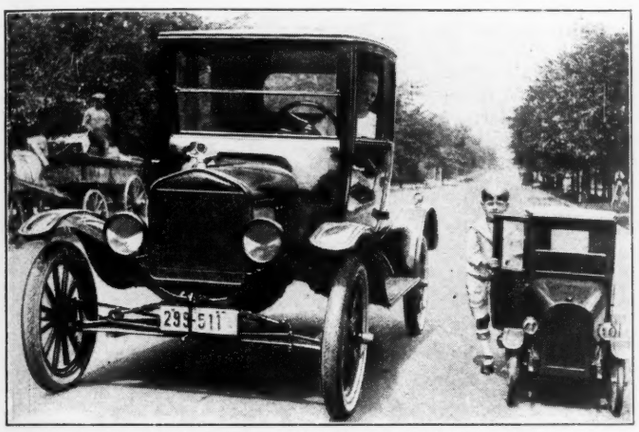
# Mammoth New Defense Gun in Public Demonstration



THE size of this mammoth coast defense gun could not fail to impress the crowds that gathered to watch its demonstration a short time ago at the Army Proving Ground, Aberdeen, Md.

The bore of the gun, which is seen plainly in the photograph, is 14 inches, one of the largest in use in America. Contrasting this great machine with coast defense guns of even a few years ago, one can appreciate the amazing progress made in designing heavy artillery.

## Wisconsin Youth Drives the Smallest Sedan



The midget sedan and its driver posed beside a Ford

A SMALL boy in Milwaukee, Wis., drives what is said to be the smallest passenger-carrying sedan ever seen on the streets. There is more difference between his car and the Ford coupé beside it than there is between a Ford and a Rolls-Royce. But it actually runs, gets its tires punctured and its engine out of order just like bigger cars.

## America's Most Active Volcano in Eruption

THIS most recent photograph of Mt. Popocatepetl shows the most active volcanic peak in the North American continent in action. The Aztec name of this strange peak of snow and fire means literally, Smoke Mountain.

Located near Puebla, in Mexico, it is sometimes called by tourists who cannot remember the spelling of the real name, the "Puebla volcano." It is the second highest summit in Mexico, rising to a height of nearly 18,000 feet, about 4000 feet higher than Pike's Peak in Colorado. The last 3000 feet of ascent must be made on foot because of loose lava and ashes. On the dome, the heat is intense and the reflection of light from the snow is blinding.

At the foot of one of its slopes is a vast lava field.

Remarkable photograph of Mt. Popocatepetl in action

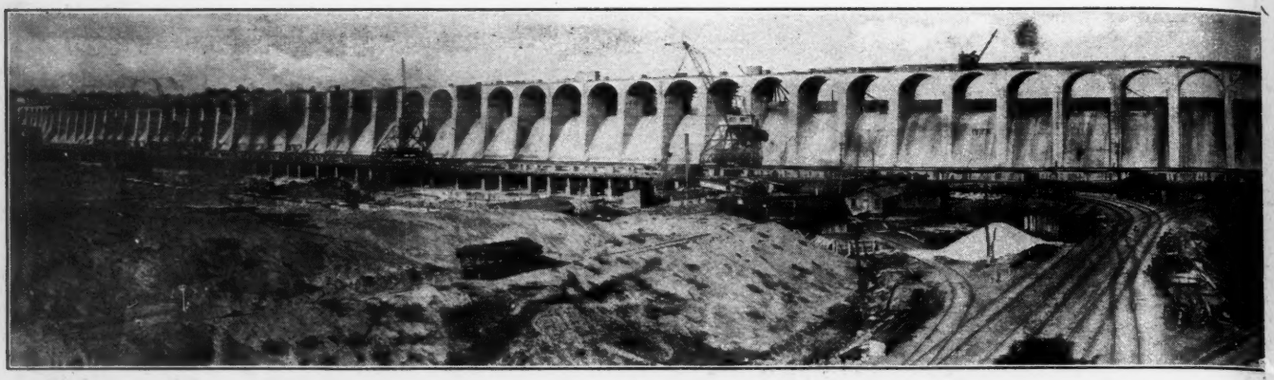
## The Loftiest Point Ever Photographed on Earth

THIS photograph of the summit of invincible Mount Everest was snapped with a small hand camera at an altitude of 28,000 feet, the highest point on earth at which a picture ever has been taken. It was made during the ill-fated attempt last year to scale the summit of the world's highest peak.

Colonel E. F. Norton, leader of the expedition, is seen at the left center. He was only 80 feet away from the camera, but it took him an hour to negotiate this distance because of extreme exhaustion and difficult footing.

The cone-shaped peak appears in the distance. It is only 300 yards away.

# The Wilson Dam at Muscle Shoals



THIS magnificent new photograph of the Wilson Dam at Muscle Shoals shows the full breadth of the immense project by which the world's greatest power dam will create the "Niagara of the South." The dam is nearly a mile long and 102 feet high, and when completed will harness the Tennessee River to supply turbines capable of generating 600,000 horsepower.

Construction of the Wilson Dam was started during the World War to supply

## Harnessing the Small Streams for Power

RAPID strides are being made toward successfully utilizing the power that may be derived from small streams. Two of the newest machines designed for this purpose are shown in these pictures.

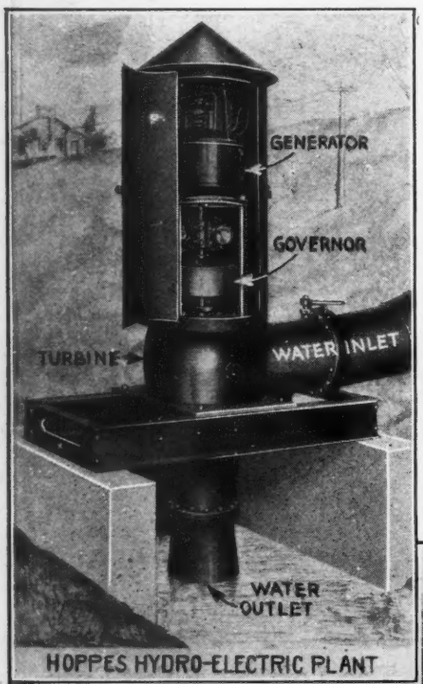
The device in the upper illustration may be operated from nothing larger than a spillway. It is a complete power unit in itself, consisting of turbine, generator, and governor housed in one cylindrical metal covering. It is of the high speed propeller type, running up to 1700 revolutions a minute. The runner shaft is connected with a direct current, 125-volt generator, permitting its use for standard lights, and general farm use.

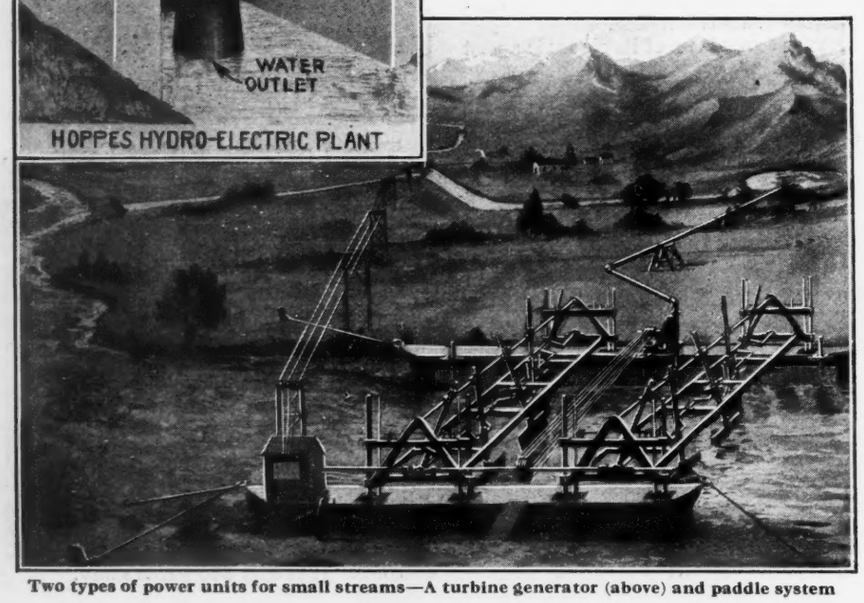
The feature of this machine is the self-contained governor that controls the speed by regulating the amount of water entering.

The second machine shown below may be built to suit the conditions of any stream, its designers claim. It consists of a multiple crankshaft, including five or more cranks connected with paddles that operate the cranks when the water strikes against them.

Any number of units may be employed.

For irrigation purposes a pressure pump is added that allows the water to be lifted for distribution over wide areas.



Two types of power units for small streams—A turbine generator (above) and paddle system

## A Perilous Job—Painting the Brooklyn Bridge

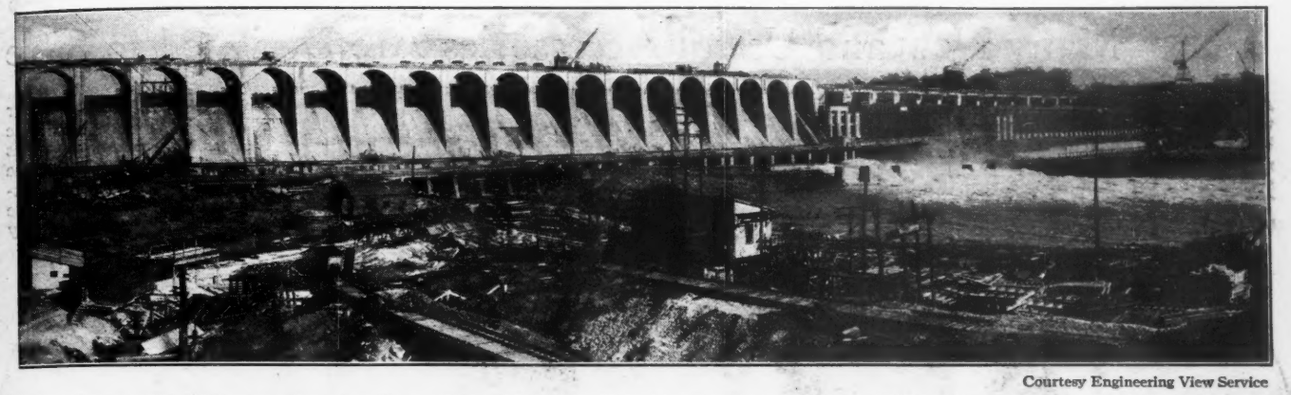
GIVING Brooklyn Bridge its annual coat of paint is a job full of peril for the men who must cling like spiders to the giant steel web. As long as the great bridge stretches across the East River, connecting the Island of Manhattan with Brooklyn, painters will have to risk their lives once a year to prevent the cables from rusting.

The photograph was taken by a dare-devil photographer from one of the high towers on the bridge. The view of the street cars crossing on the bridge below gives an idea of the dizzy height from which the camera was snapped.

## What Do You Want to Know?

POPULAR SCIENCE MONTHLY will be glad to answer questions from readers on subjects of general science, mechanics and radio. Address your questions to the Information Department, POPULAR SCIENCE MONTHLY, 250 Fourth Avenue, New York City, inclosing a self-addressed stamped envelope.

# —A Future "Niagara of the South"



Courtesy Engineering View Service

power for a great nitrate plant for the manufacture of explosives. When it was one-third completed at a cost of $17,000,000, work on it ceased. Its completion will mean that the Southern States will have a water power plant second only to Niagara, and one of the greatest agricultural and industrial areas in the United States. It also may make possible the peacetime operation of a fertilizer plant that may revolutionize farming in the South and East.

# How Everest Climbers Bridged Treacherous Chasms

AT THE highest altitudes ever reached on earth, members of the recent Mount Everest Expedition crept across crevasses of inconceivable depth on the rungs of a portable ladder. Of the many unusual bridges in the world there is probably none possessing strength as great for its weight as the remarkable ladder bridge carried by those daring explorers.

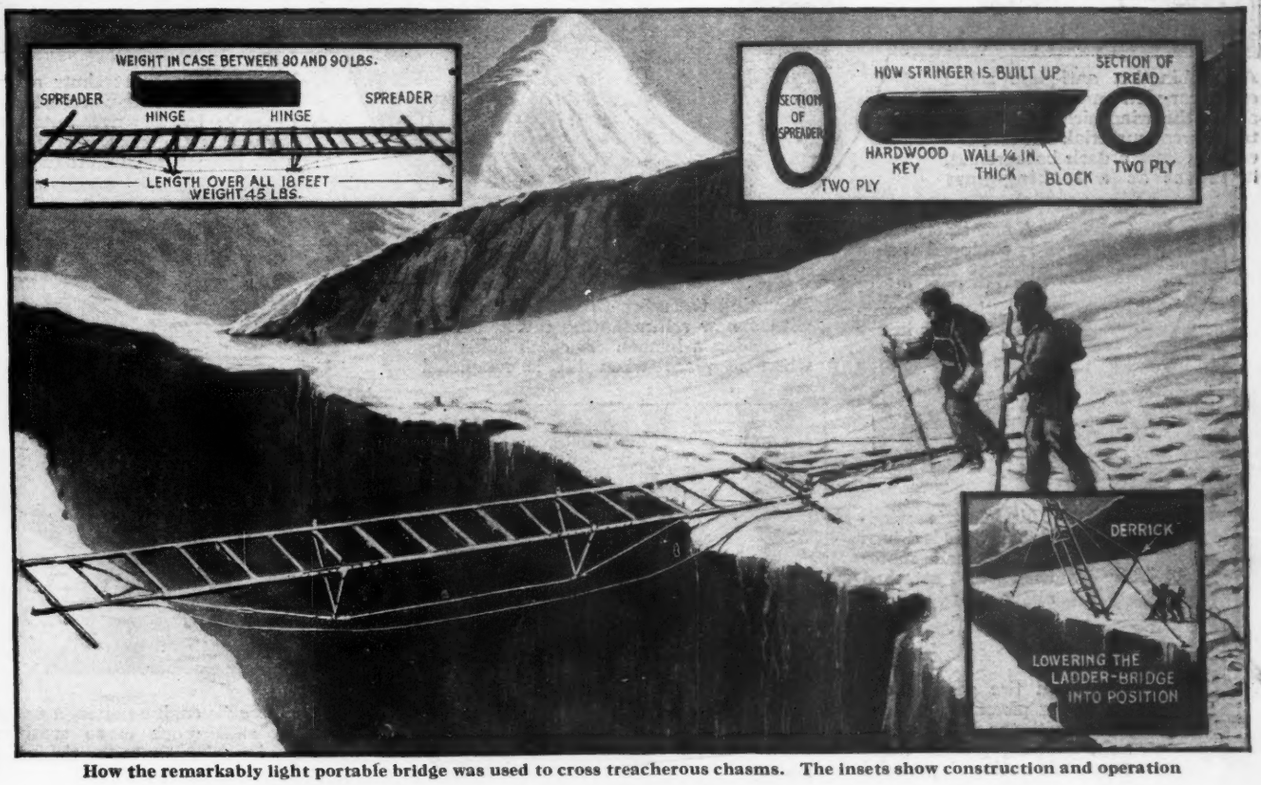
The bridge was made specially by an English firm for use at an altitude of 24,000 feet and upward. In view of the difficulties of transport at this tremendous height, it was essential that it should be extremely light and easily carried. To meet these requirements it was constructed of hollow wooden spars, put together with hinges in three sections, each of which could be used as a separate unit. Extended full length the bridge measured 18 feet and weighed only 45 pounds.

Adjustable spreaders of hollow spar were provided at each end of the bridge to give a firm resting surface in the snow or ice, while a light hollow derrick was used to lower the structure safely across a chasm. The walls of the hollow bridge rails were barely one-quarter of an inch thick, while those of the rungs were not more than three-sixteenths of an inch thick.

Stretched at full length, the bridge could support two fully equipped climbers, and when used in an upright position as a ladder, each rung was strong enough to support a concentrated weight of 300 pounds. This great strength was due to the direction of the grain and the system of layers of wood of which the hollow sticks were made. The same principle is being applied in the construction of hollow spars for racing yachts and for airplanes.

Spruce wood is sawed into planks less than one-quarter inch thick, then bent around steam-heated mandrels to the form of cylinders. The bent planks then are built in the requisite number of layers round a wooden core and the layers glued together with water-tight glue.

When the core is withdrawn, there remains a hollow spar that is far superior in strength and weather-resisting properties to a solid stick. Proportioned correctly, a hollow spar of one-third the weight is as strong as a solid spar of the same size.

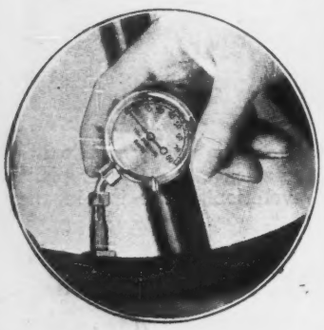



How the remarkably light portable bridge was used to cross treacherous chasms. The insets show construction and operation

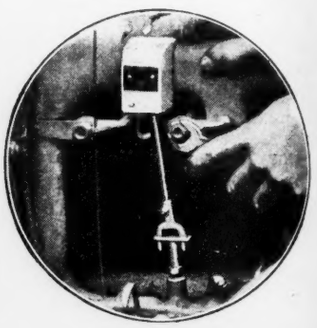
# What Inventors Are Adding

## Many New and Useful Accessories Are Designed to Save

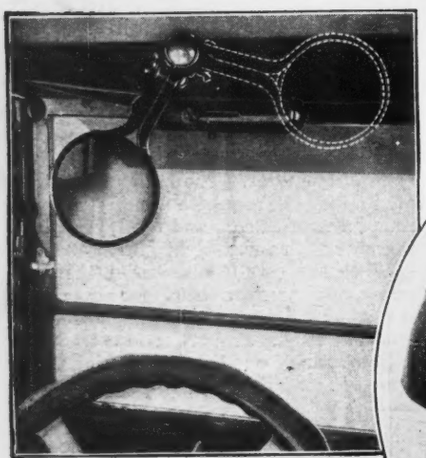
A new tire gage of the dial type, resembling a watch, has a curved neck that permits easy access to the valve stem on all types of wheels. The crystal of this new pressure gage is non-breakable



This automatic carburetor control, operating on the thermostatic principle, turns down the needle valve as the engine warms up, thus effecting a saving in gasoline. The device is attached easily

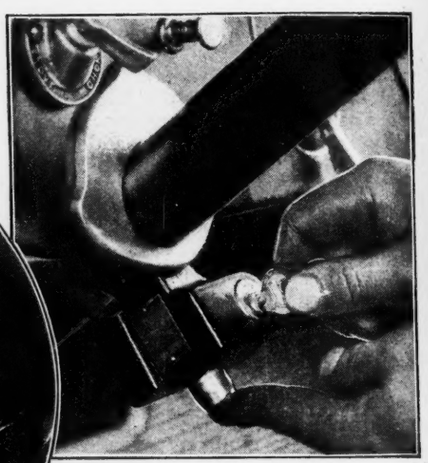


Smoking in comfort while driving is possible with this extension tube device. The cigarette holder has a suction cap that fastens it to the outside of the windshield



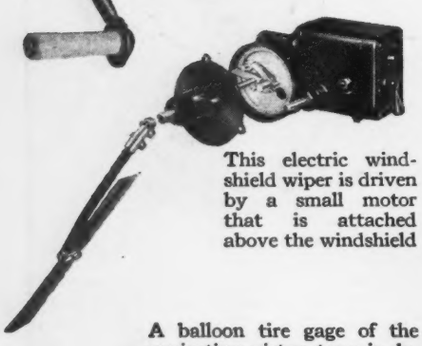
A combination anti-glare shield and rear-view mirror, attached above the windshield is of semi-transparent material. Swung upward against a dark background, it serves as a looking-glass

Mounting the spare tire is accomplished with a new self-mounting carrier simply by pulling a handle. A catch holds the wheel in place when lift is completed

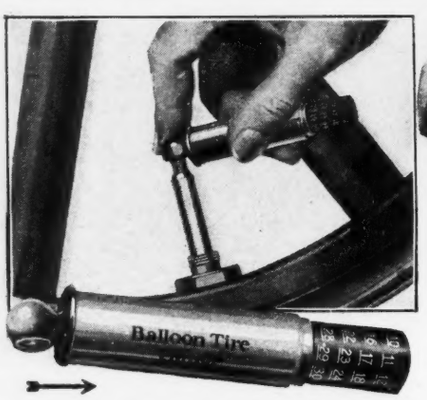


When the motorist shuts off his engine, the steering-wheel is locked instantly by this new automatic device attached below the steering-post. A key is required to unlock it

A new safety crank is equipped with a ratchet that prevents the "kick-back" that sometimes causes injury



This electric windshield wiper is driven by a small motor that is attached above the windshield



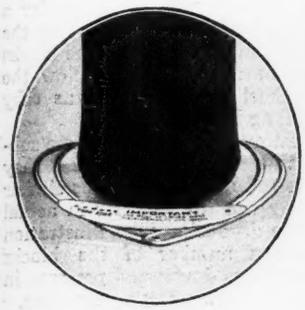

A balloon tire gage of the projecting piston type is designed with the nipple at the side, allowing greater clearance while testing air pressure

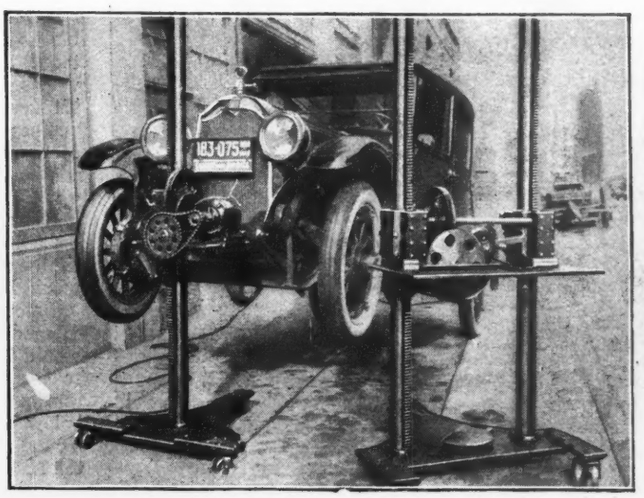
To detect auto-engine noises, a newly invented stethoscope is so sensitive that any irregularities in the ticking of a watch can be heard very plainly

# to the Motorists' Enjoyment

## Labor and Make Your Car More Efficient and Convenient

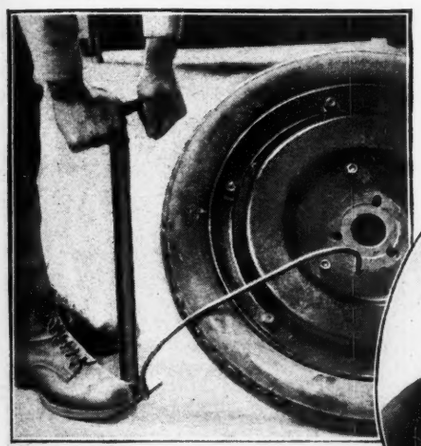
Adjustable calipers have been devised to determine whether balloon tires are properly inflated. The calipers are set to the width to which a tire of a given size should bulge under a given normal load



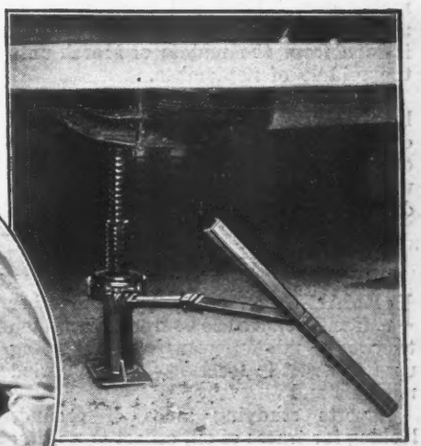


A portable electric hoist for autos. Through a system of gears operated by a half-horsepower motor, a platform to which the car is hooked is moved on double or single vertical steel posts

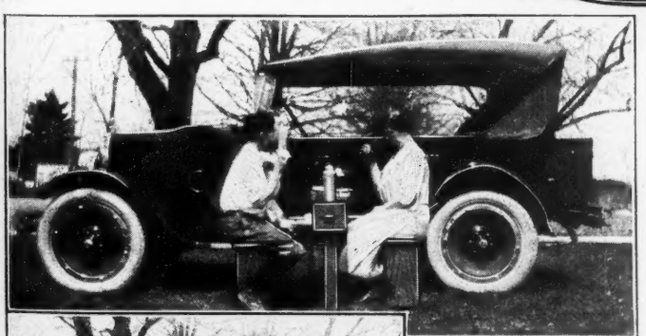
A small red light strapped to the back of the driver's signaling hand is a new aid in preventing night driving accidents. It is held by rubber cords around wrist and middle finger as shown

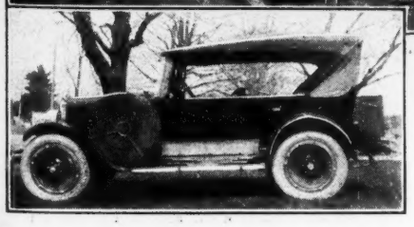


Here is an unusual new type of automobile wheel containing a huge inner tube that extends beyond the rim so that half of it is inclosed between the two metal disks that form the wheel. The illustration above shows how the tire is inflated from the center of the disk

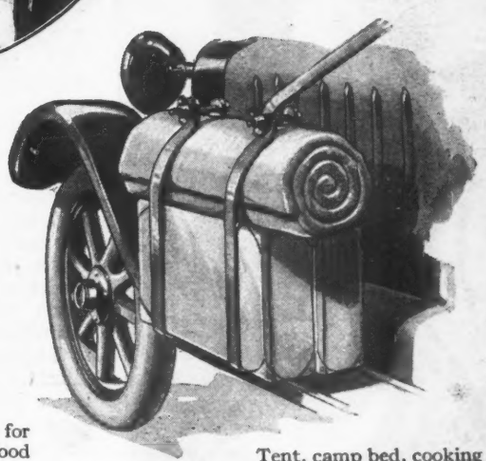


This special jack for cars equipped with balloon tires has the exceptional lift of 17 inches. A 36-inch folding handle makes it easy to operate. It is the two-screw type





An ingenious folding lunch outfit for the tourist or camper combines a food container, table, and two benches that will seat four persons, as shown above. The entire outfit, when folded, rides easily on the runningboard, as shown in the photograph at the left

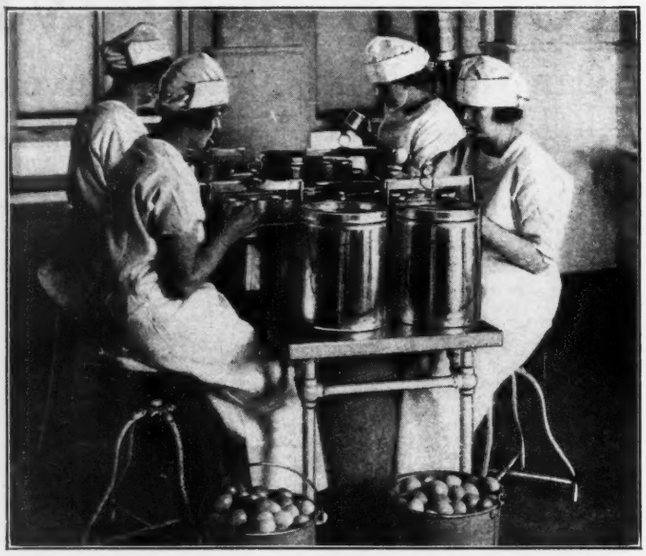


Tent, camp bed, cooking outfit, suitcases and blankets for two can be carried in this compact kit on the runningboard of a car. The roll and suitcases are fastened firmly by strips of metal bolted to the runningboard and clamped together above the blanket roll

# How Frozen Eggs Are Canned for the Market

MORE than fifty million pounds of canned frozen eggs are used annually in the United States by restaurants, hotels, and in home cooking. They cost from three to five cents a pound less than unshelled eggs and are more easily handled.

The first process in egg canning is chilling the eggs in a room at a temperature of 31° F. for from 12 to 24 hours. This stiffens the whites and makes it easier to separate the whites from the yolks.



Separating the yolks from the whites preparatory to freezing

Girls then candle the eggs to detect and remove bad or moldy ones. Each girl candles, on an average, 900 dozen a day. Egg canning is done from the middle of March until the middle of September.

From the candlers the eggs pass to the breakers, who open and separate them if desired. Canned eggs are sold in the form of whites only, yolks only, or mixed whites and yolks. If no musty eggs are discovered, they then are packed in wax lined cans and sent to the freezing room, where they remain for 72 hours at from zero to four degrees below zero temperature.

The entire process, from the breaking of the egg until it reaches the freezing room, takes only eight minutes.

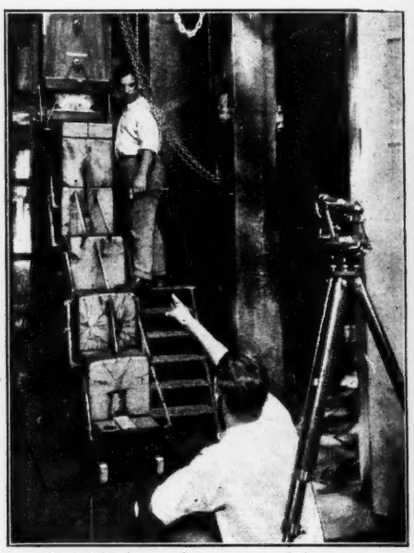
The last step is wrapping the frozen eggs in heavy paper and placing them in refrigerator cars, in which they start on their journey to all parts of the world.

# Ship's Blocks Are Tested in Forest Laboratory

THE Forest Products Laboratory at Madison, Wis., has begun a series of tests to determine the strength of keel blocks used to support the hulls of ships while in drydock. When these keel blocks fail, the hull drops with the shattered timbers and is damaged, usually very seriously, so that the importance of the keel blocks is easily seen.

These blocks are 14-by-14-inch timbers of clear white oak. The tests of five sample keel blocks were made under a giant column-testing machine with the load transmitted to the top of the blocks by a roller bearing, so as to allow the timbers to keel over sideways as they would in falling beneath a ship.

Before testing, these timbers were submerged in water for a week so that they would be tested under conditions similar to those they would encounter in actual service in the drydock. The illustration below shows a number of the blocks under tremendous downward pressure in the laboratory column-testing machine.



Keel blocks under tests in laboratory

# Study of Fossils Reveals Oil Deposits

REMAINS of tiny shellfish and other fossils believed to be from five million to twenty million years old, are being used to assist in locating fields of buried minerals and oils.

Experts studying areas of ground, looking for traces of oil, collect these tiny fossils, some of which are so small that they must be picked up with camel's-hair brushes, and send them to the laboratories of the U. S. Geological Survey in Washington for classification. The fossils are reproduced in photographs enlarged from 25 to 150 times, so that their characteristics may be recognized easily.

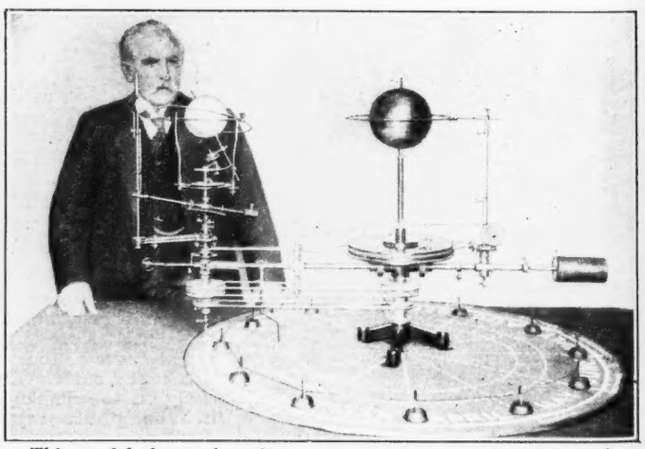
Fossils millions of years old often are marked very faintly. A blowpipe is used to spray white liquid over these shells to make the almost invisible markings stand out under the microscope.

Spraying fossil shell for the microscope

# Astronomy now Taught by Mechanical Model

WHY can we see only one side of the moon? What causes eclipses of the moon and sun? When will there be another eclipse of the sun? What causes the seasons?

Questions like these can be answered readily and with extraordinary clearness by means of a fascinating model of the sun, moon and earth completed recently in England for use in schools and colleges. The relative sizes of the three bodies, and their motions, showing their positions in respect to each other on every day of the year are accurately represented, so that by merely turning a handle the student can see for himself the things that sound so complicated in textbooks.



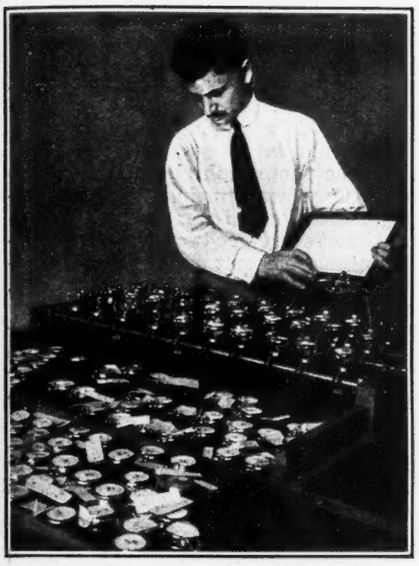
This model shows the relative courses of sun, moon, and earth

## Watchmakers Must Pass Rigid Examinations

TO MAKE sure that all jewelers displaying watchmaker's signs in their shops are really experts in their trade, the U. S. Horological Institute conducts examinations of all applicants before issuing licenses by carefully examining samples sent in as a preliminary test of skill on the part of the applicant.

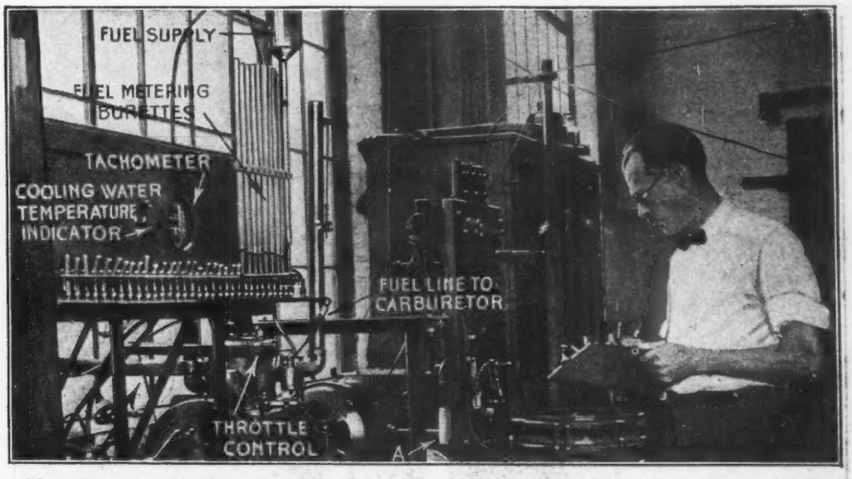
To keep the public from being imposed upon by incompetent men, the examination consists of two parts. The first part is a written examination in which the applicants are expected to show their theoretical knowledge of watches. For the second part a damaged watch is sent to the applicant. This he must repair to the best of his ability. These test watches previously have been put out of order by the institute so that the repair work may easily be graded.

The photograph shows R. E. Gould of the Horological Institute, checking up on repair tests by an electrical timing device.



Testing the accuracy of repaired watches

## Blended Motor Fuels Are Put to the Test




M. A. Thorne of the Bureau of Standards, testing blended gasoline with the new apparatus

SO MANY blended fuels are on the market now that the average motorist is puzzled as to which to choose. Nearly every time he drives up to a new filling station, a new mixture is recommended to him and he has no way of telling which ones are good and which ones poor. Among the advantages claimed for most of these special fuels are increased mileage, more power, prevention of carbon formation, and elimination of knocking.

Coming to the motorist's assistance, the U. S. Bureau of Standards recently has developed a method of testing these special fuels to determine whether they are better than ordinary commercial gasoline in regard to economy, power, and prevention of irritating knocking.

In the photograph M. A. Thorne of the Bureau of Standards is seen with the new testing apparatus. He has a small, high-compression gasoline engine attached to an electric dynamometer, which is used first as a motor to crank the engine. After the engine is started, the dynamometer is used as a generator and the engine speed is controlled by varying the electrical load.

The power developed by the engine is computed from readings of a spring balance applied at the end of a torque arm. Fuel economy is determined by a fuel-metering device consisting of a series of burettes, or tubes graduated to scale.

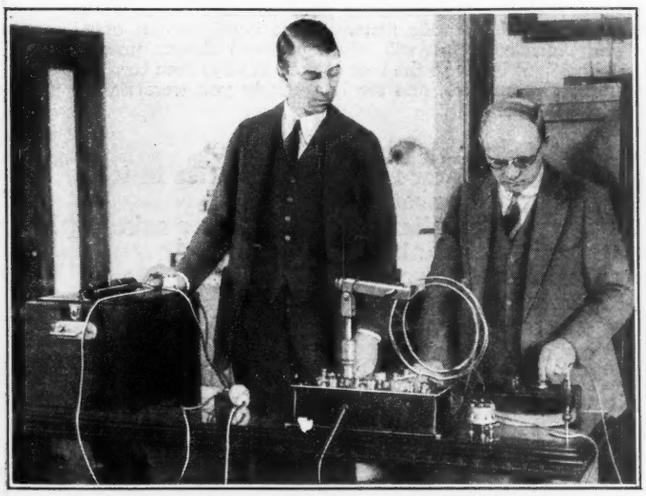
## Electrical Machine Records Heart Energy

BASED on the theory that the human heart generates small electric currents, a new machine for recording heart action was tested recently at the Ellis Hospital in Schenectady, N. Y. The instrument measures the difference in voltage between various parts of the body, and is actuated by energy that comes from the patient in the form of tiny electric impulses. This energy is so small that for detection it must be amplified much as a radio wave is amplified.

The instrument that measures heart action

## Seeks New Cures by Means of Radio Waves

IN HIS laboratory at Alpine, N. J., Dr. J. Clawson Burnett has been perfecting the oscilloclast, an instrument designed to heal human diseases by means of electromagnetic waves.

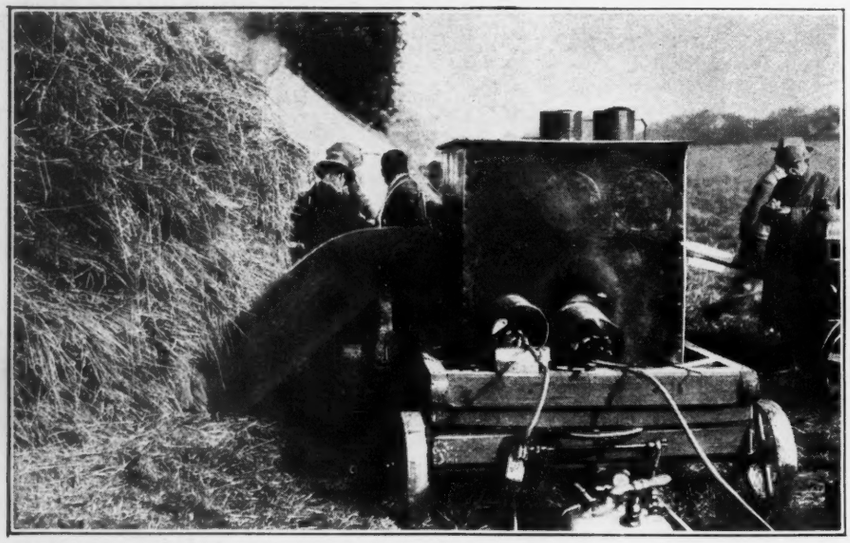


Dr. J. Clawson Burnett (right) at work in his laboratory

After experimenting for two years with the machine, the invention of the late Dr. Albert Abrams of California, which raised a storm of criticism, Doctor Burnett says he is now ready to place his results before scientific societies for examination.

Just as radiophones respond to electromagnetic waves, so may the human body be affected, according to Doctor Burnett.

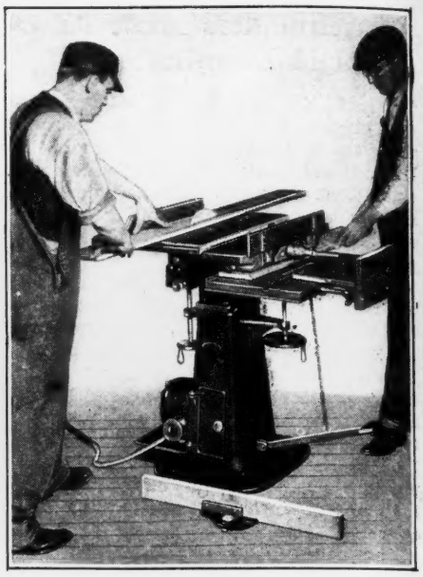
# Artificial Heat Now Dries Hay Crops



"MAKE hay while the sun shines," urges the old proverb. But what shall the unlucky farmer do if the capricious sun refuses to lend its assistance during the haying season? Thousands of acres of crops are lost every year on account of rainy weather at the critical period.

In England, where damp and foggy weather, common during certain seasons, makes a good hay crop rare, a new device recently has been patented by Captain B. J. Owen, which dries hay by means of artificial heat. The hay is stacked while it is green and then it is dried in 25-ton stacks.

The photograph shows the system of pumping and drying. Heat is conducted through a large pipe to the interior of the stack.



## Mechanical Cabinetmaker Combines Five Machines

FIVE complete woodworking machines with all adjustments are combined in this unusually compact mechanical cabinetmaker. It includes a sawtable, jointer, thickness planer, boring table, and speed spindle.

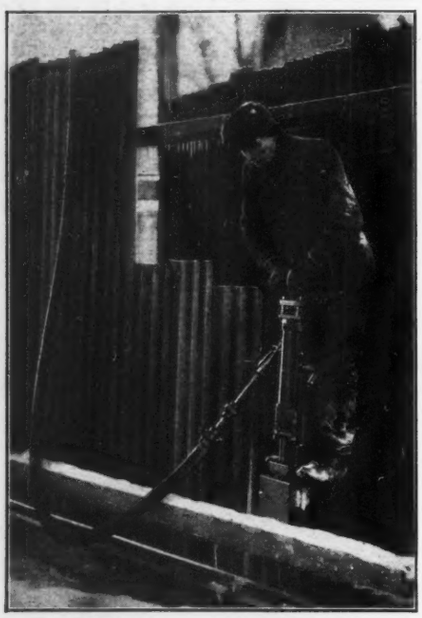
In the photograph above three operations are shown—ripping, thickness planing, and hollow-chisel mortising.

Almost every woodworking operation—20 entirely different and practical ones—are said to be performed on this machine, which can be used on both long, heavy work and small, accurate work. Four men can work on the machine at the same time. The stability of the machine for group work makes it especially valuable in manual-training classes.

The machine is of strong construction. It is equipped with a one-horsepower motor, and takes only 28 by 41 inches of floor space.

## To Produce More Helium

THE U. S. Navy Department soon will begin developing additional supplies of helium gas for airships, it is announced. At the present rate of helium production in the United States, it would require four months to obtain enough of the gas to fill the bag of the dirigible *Los Angeles*, formerly the ZR-3. In developing helium and constructing a plant for its extraction, Uncle Sam already has spent more than $5,000,000.



## A Portable Power Hammer for Light Work

FOR lighter grades of work, such as sewer jobs and small trenches where light timber or steel sheeting is employed, the big automatic hammer is practically useless. For these jobs a new hammer much reduced in size is convenient and economical.

It can be used in close quarters, needing only half an inch clearance. It embodies all of the features of the large hammers and is carried about easily. The photograph shows the hammer in use for driving light sheeting for a trench.

## How Much Science Do You Know?

THE man who has stored in the back of his head a working knowledge of the fundamental facts of science possesses an important asset in these days of scientific achievement, whatever his work may be. For that reason POPULAR SCIENCE MONTHLY publishes each month a list of a dozen questions about scientific facts. These questions not only will help test your knowledge, but will afford you real entertainment.

Answer the 12 questions below to the best of your ability, then turn to page 157 for the correct answers, and see how nearly you were right. See if you can score 100 per cent.

1. Why do some people get bald?
2. Does the boiling of water remove impurities in it?
3. What is the lightest substance known?
4. Why does a snowflake fall more slowly than a raindrop?
5. Why do we believe that all stars are moving?
6. Which travels faster, electricity or light?
7. Do insects have brains like ours?
8. Why does radio go through walls?
9. Are there special brain foods?
10. Why can parrots talk?
11. If the air weighs 15 pounds to the square inch, why does it not press us flat?
12. What makes the spouting geysers in Yellowstone Park?

# Mechanical Merry-Go-Round and See-Saw for Children

AROUND they go on their merry-go-round, and up and down on their see-saws, for the ingenious new mechanical plaything seen in the photograph is a combination of the two amusements. As it teeters, it revolves—this "merry-go-bob," which seems sure to find favor with children who like to make things go by their own efforts.

The play machine is substantially made of iron and will not tip over. The children make it go by pushing on pedals and pulling handles.

The plaything can be used in the nursery as well as on the lawn. Four children need to cooperate to run the merry-go-bob, but it is safe to say that its operation need not cease on account of lack of passengers, at least if the plaything is standing in plain sight of the children somewhere out of doors.

## Flaws in Big Guns Are Revealed by X-Ray

THE use of a newly devised X-ray testing apparatus soon may make it possible to detect flaws in large guns and other ordnance, which, if not found, might cause disastrous explosions such as have occurred in the past. This was the recent statement of Col. T. C. Dickson, of the Ordnance Department of the U. S. Army, speaking before the American Society of Mechanical Engineers.

A 280,000-volt X-ray equipment has been put into operation in the laboratories of the Watertown, Mass., Arsenal. With this apparatus clear films of steel up to three inches in thickness can be obtained, according to Colonel Dickson, but so far there has been little success with steel more than three inches thick.

"The experience with the equipment," he said, "has demonstrated that it has great practical value in showing methods by which sound steel castings can be produced, and as an instrument of inspection.

"The removal of all defects, or their location where they do harm, makes possible a material saving in the weight of castings. The cost of making X-ray films of castings is far less than the cost of cutting up castings to ascertain their soundness."

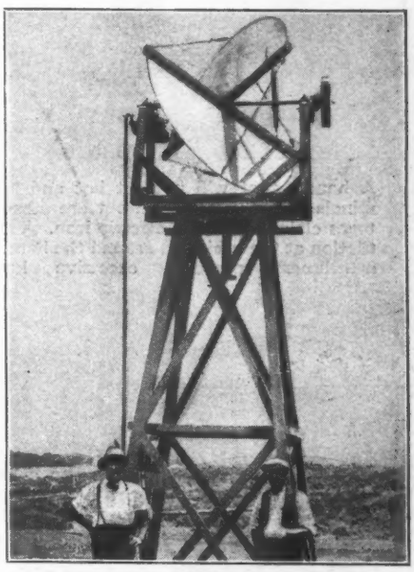
## Know Your Car

**Starting troubles,** which come regularly with zero temperatures, can be lessened by a few simple precautions. In winter the main resistance to cranking is the stiffened, chilled oil film on the cylinder walls. If you keep your car in a cold garage, add warm water to the engine jackets. This will heat the oil film on the cylinder walls and give a cranking speed sufficiently high for starting.

At zero the capacity of the battery is only about half of that at summer temperatures, and the voltage drops very low with large current drains. During the winter much greater demands are made on the battery. Starting requires a much larger current, the lights are burned longer, and few long trips are made that might keep the battery charged. Test your battery frequently during the winter, therefore, and if it is much below the charged condition, have it charged from an outside source.

Gasoline cannot be ignited until it is in a vaporized state, and at low temperatures it vaporizes slowly. Hasten this ignition by turning the engine over a few times, with the carburetor choke closed, then allow the engine to stand for two or three minutes before using the starter again. This wait allows the gasoline to continue vaporizing in the cylinder until an explosive mixture is obtained. Hot water poured over the carburetor and intake manifold helps also to vaporize the gasoline more quickly. It is well to carry a thermos bottle of boiling water in the car for this purpose.

After the engine is started, conserve its heat by using a radiator shutter, and, in very cold weather a hood cover.



## New Type of Windmill Runs without a Vane

TWO South Africans, Messrs. Oohlson and Henning, are the inventors of this new type of vaneless windmill designed so that its sails will operate and drive the pump rod without shifting their direction according to the direction of the wind. Two semicircular sails are arranged at right angles to each other in such a way that a surface always is presented to the wind.

The inventors are shown with their creation, the cost of which is said to have been less than $50.

The height of the windmill is 20 feet. It is geared in a ratio of five to one and is so powerful that two men of average weight can hang on the driving rod without impeding the work of the mill. The home of the inventors is Port Elizabeth.

# New Inventions to Lighten

## Here Are 16 Useful Mechanical Utensils and

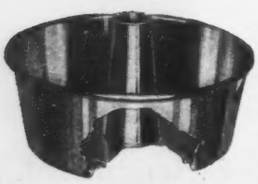
This light electric iron for shaping hats can be used with a handle, or clamped in a stationary base

A handle that will not get hot and terminals that will not burn out are advantages claimed for this electric iron. Ventilation at the back and around the handle attachment prevents excessive heat

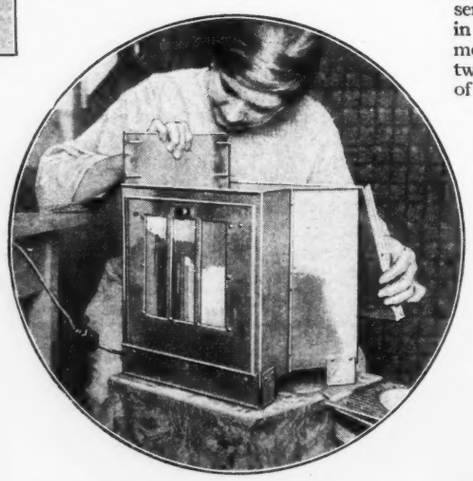
Sprung into the mouth of the milk pitcher and turned to engage a notch, this strainer lid protects the contents from dirt and flies

A mechanism that tilts and rolls the tub, sending the suds whirling swiftly around in three complete figure-eight movements, producing unusual friction between the clothes and water, is a feature of the new electric washer shown above

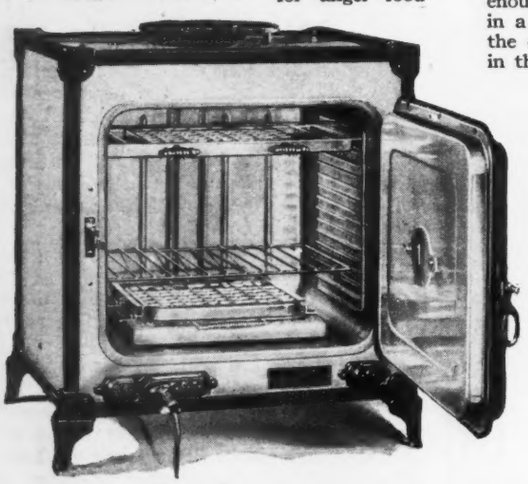




This new cake-pan has two removable bottoms, a flat one for layer cakes, and one with a tubular center for angel food



A collapsible oven, small enough when folded to fit in a suitcase, is useful for the camper, or convenient in the smallest kitchenette



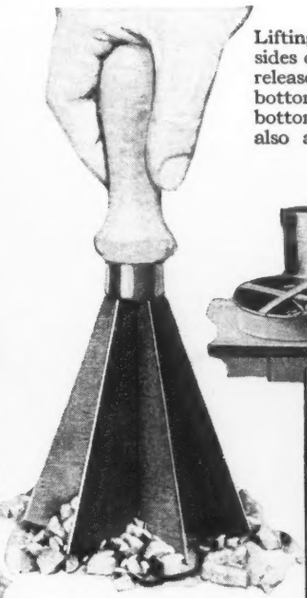
Although small enough to be placed on a shelf, the compact electric range shown at the left has ample capacity to do every sort of cooking for a family of five. At the top is a "quick boil" heater. The oven may be used also as a fireless cooker

When not in use, the electric sewing machine pictured below is concealed in an ornamental table. If a door is opened at the front, the table becomes a convenient writing-desk, with compartments for paper and pens

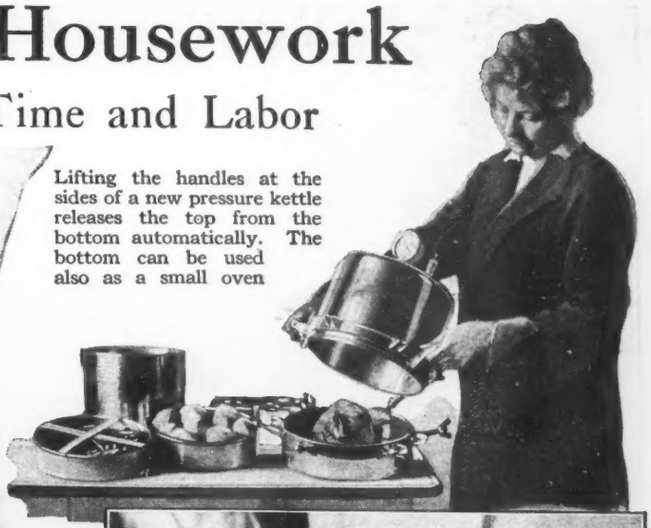
# the Drudgery of Housework

## Electrical Appliances to Save Time and Labor

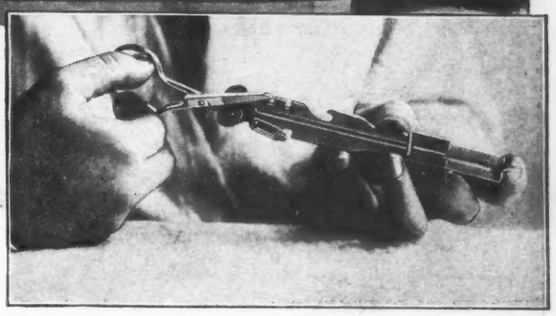
Washing and wiping windows may be accomplished in a single operation by using the newly patented window-cleaning brush shown above. A narrow strip of hard rubber for wiping is attached to the same handle as the brush, following it across the surface of the window



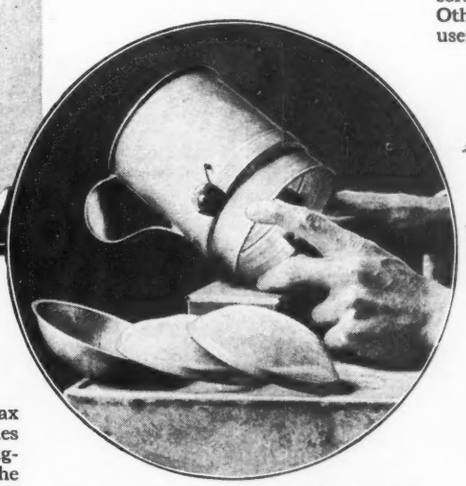
A four-bladed chopper with knives radiating from the center facilitates chopping meat or vegetables



Lifting the handles at the sides of a new pressure kettle releases the top from the bottom automatically. The bottom can be used also as a small oven



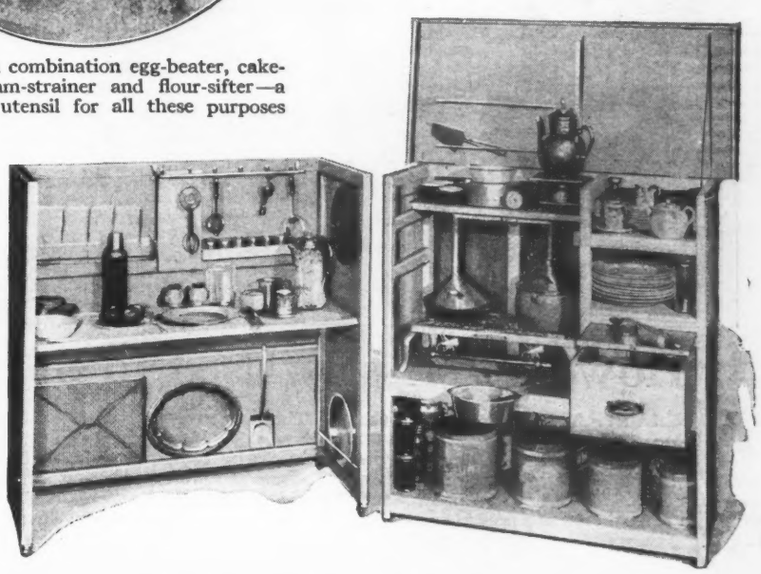
The grinding wheels of this all-purpose household tool can be used to sharpen knives, scissors, the lawn-mower, or any other edged tools. Other ingenious parts of the device make it useful as a can- and bottle-opener, or glass-cutter



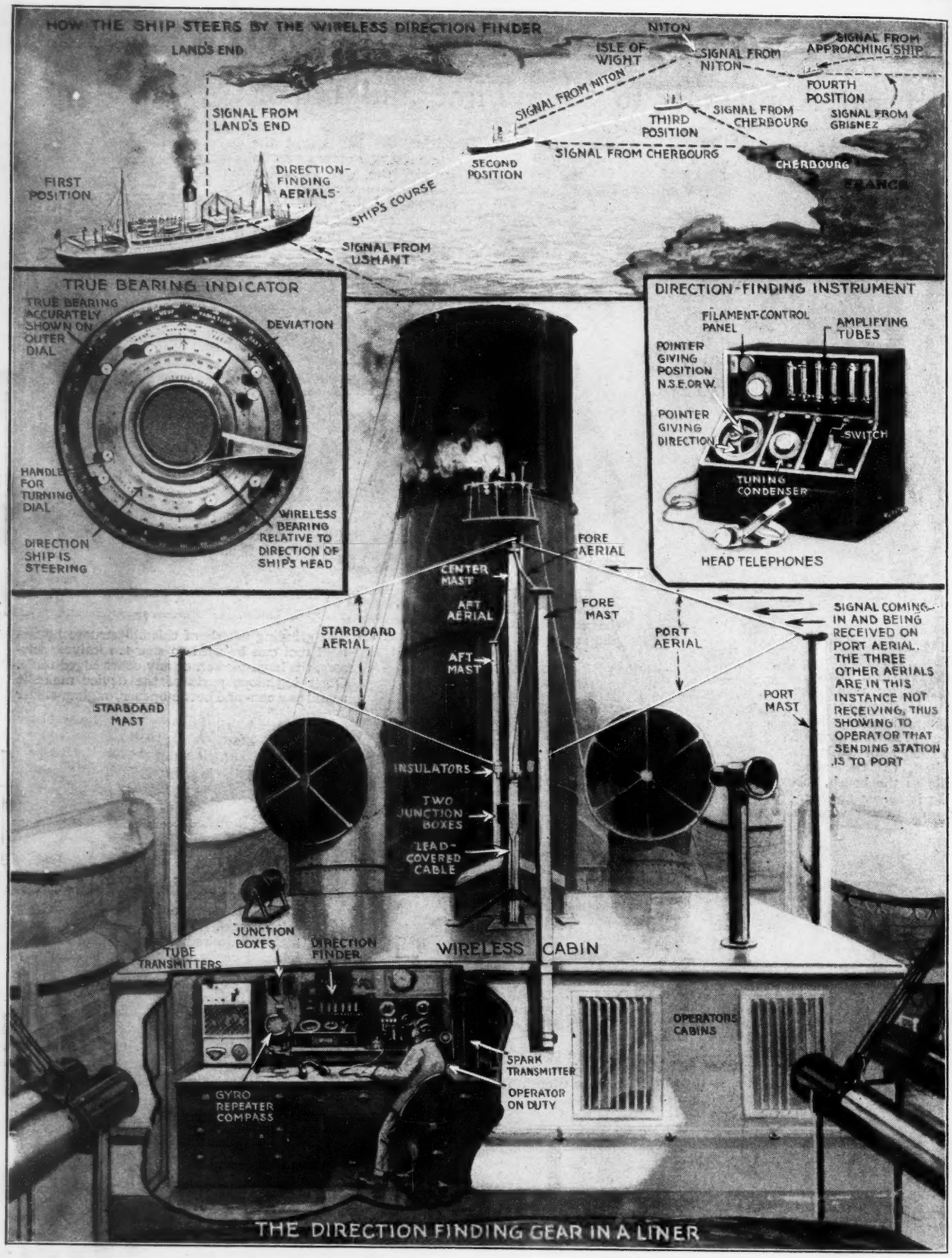
Here is a combination egg-beater, cake-mixer, jam-strainer and flour-sifter—a compact utensil for all these purposes

A fork and spoon are hinged together in this utensil to form a handy salad tongs. They can be used separately, if desired, for the hinge may be released easily whenever it is necessary

Caring for wax floors becomes less of a drudgery with the sliding combination waxer, polisher and brusher pictured below. It is about the weight of a carpet sweeper



A completely equipped, odorless kitchenette, which resembles a neat chest of drawers when closed, should appeal to the woman who has to keep house in limited quarters




THE DIRECTION FINDING GEAR IN A LINER

# How Wireless Is Used to Steer Vessels into Port

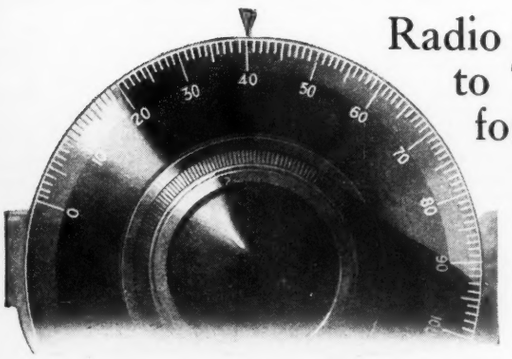
AN ILLUSTRATED article in the December issue of POPULAR SCIENCE MONTHLY described an amazing new use for Marconi's system of reflected beam radio transmission—the "radio lighthouse" which, in recent tests, has proved successful in guiding ships through heavy fogs.

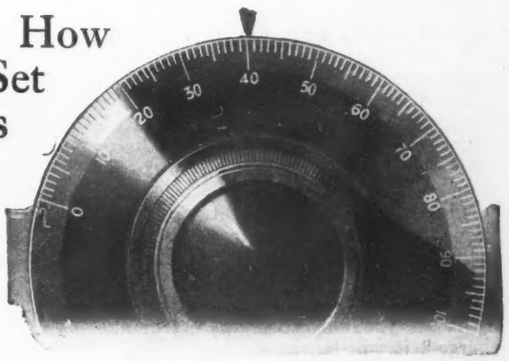
The illustrations above show the apparatus that enables the ship pilot to get his bearings by these radio signals from shore. The top picture represents a steamer being guided through the English Channel by them.

Four aerials on the ship receive signals from every direction. The aerial on which the sound comes in loudest is the one nearest the transmitting station. On receipt of the signal, the operator determines, by the direction-finding instrument, its exact direction. This is sent to the navigating officer who, manipulating the dials of an indicator, finds out the true bearing of the ship.

# Your Dials—Keys to the Air

## Radio Expert Tells How to Tune Your Set for Best Results





*By Jack Binns*
*America's Most Popular Writer on Radio*

THERE are certain little knacks in tuning a radio set that come with experience and knowledge of the set itself, but that can be acquired by any novice without great difficulty. In this article I shall outline the best methods of tuning for each of the basic systems of reception in general use. Owing to the diversity of types of receivers, there will be a few variations that cannot possibly be covered, but the procedure that I shall describe will give you, I hope, sufficient information to act as a guide to the most satisfactory results.

The majority of crystal receivers employ either galena, or some synthetic substance very much like it. The actual adjustment of the crystal, therefore, is identical in all cases.

Receivers using a crystal alone, without vacuum tubes, are at once the simplest and most difficult to tune. This sounds paradoxical, but is true. In a large number of cases there is only one dial on the set, and in the majority not more than two. These are extremely simple to adjust, because a station will be heard over a large number of the degree marks on the dials. This part of the tuning consequently is simple. The difficult thing is to tune out an interfering station, whenever one is heard.

BEFORE proceeding further I am going to lay down a very imperative rule—one that applies to every type of radio receiver and to every operator. In turning any dial on your set, move it as if the whole world depended upon the slightest fraction of space between each of the degree marks on the edge of the dial. In other words, move it as slowly as you possibly can. For good results there is no variation to this rule.

Before signals can be received on a crystal set, the delicate little wire, often called the "catwhisker," which touches the glistening surface of the crystal must be in the right position, and it must rest on the surface as lightly as possible. Experience will show that there are a few spots that give much louder response in the telephones than the rest of the surface of the crystal. These places are known as the "sensitive spots." Once one of these has been found, the crystal should be let alone until some accidental jar or shock knocks the wire off that particular spot, when a readjustment will be necessary. In doing so, move the wire very carefully and do not press it down.

If you happen to have a crystal set with a dial marked "coupling," keep this in the minimum position if you experience interference. If you have no such dial, and still get interference, then my advice is to shorten the length of your antenna. Remember that the maximum effective range is 50 miles. Do not try to reach out with your set by putting up a long antenna. Be content to get good clear reception from your local stations with a minimum of interference.

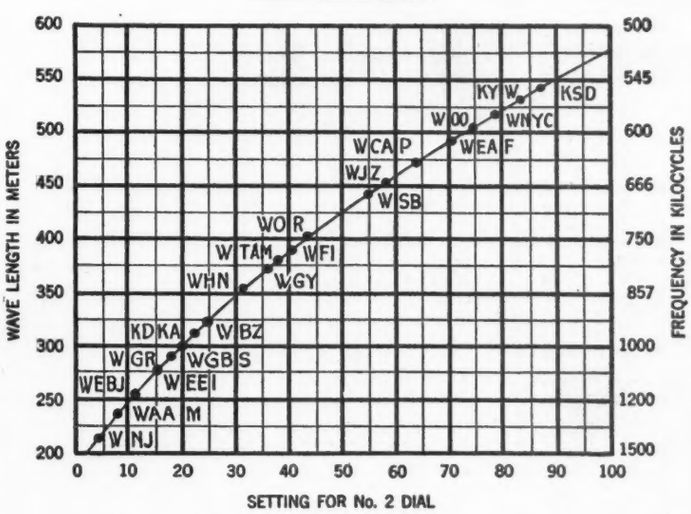
The owner of a regenerative set owes it to the other radio fans to move his dials carefully. The regenerative receiver, properly constructed, is selective and sensitive. When poorly operated, however, it is a fairly powerful transmitter, and as such will cause interference to others. Moreover, when it is in a transmitting condition it is absolutely useless as a receiver, for it is uncontrollable.

There is a large variety of regenerative receivers, from a technical point of view. In addition, there are several different ways in which the control dials are marked. Invariably, however, they will fall within two groups: First, dials marked "Tuning," "Selector," or "Wavelength," for tuning in the desired station; second, dials marked "Regeneration," "Intensity," or "Volume," for controlling regeneration or the intensity of the signal.

Do not, under any circumstances, tune this type of receiver so that you get a sharp whistle of varied pitch. This is a sign that your set has ceased its proper function of receiving, and has transformed itself into a transmitter. In that condition it is of no value to you or any one else.

BEFORE you turn your set on, either with a battery switch, or by the little dials marked "Rheostat," set the regeneration dial at zero. Now tune with the dial that controls the wave length. Move the dial slowly until a station is heard. Then turn the regeneration or volume dial slowly up from zero. As you do so you will observe that the signals become stronger and stronger until finally they reach a point where they begin to sound mushy and blurred. Stop immediately and go back to the point just before they began to distort. Or, better yet, turn down the detector tube with the rheostat dial until the mushiness disappears. This method prolongs the

CALIBRATION CURVE




**A Quick and Easy Way to Dial Broadcasting Stations**

On a sheet of paper ruled in squares, number the vertical lines from left to right to correspond with dial settings, from 0 to 100, as shown. Then, at the left side, number the horizontal lines for wave lengths, reading upward from 200 to 600. On the right side number the same lines for frequencies in kilocycles, reading downward from 500 to 1500. Now tune in five or six stations on your set, and note the dial reading for each. Then on the chart where the vertical line corresponding to each reading would intersect the horizontal line corresponding to the wave length or frequency of the station, make a dot. When you have done this for each station, connect the dots with a line. This will give you a calibration curve, by which you can locate any other desired station on your dial simply by noting where the wave-length line for that station intersects your curve. The vertical line at this intersection gives you the dial reading. Of course, since the lines represent round numbers only a close approximation of the settings is possible; but usually you will find that this chart will be amply sufficient

life of the tube. Now advance the intensity dial again to the point where you get maximum signal strength without any distortion.

NOW you have tuned your set so that you can enjoy the broadcasting without disturbing your neighbor. Make a record of the settings of both dials so that you can tune in the station again when you want to listen to it. After a little practice you will be able to change from one wave length to another with a hand always on each dial so that you can keep your receiver from oscillating and yet have it adjusted so that it will be sensitive and selective.

You will find that as the battery that lights the vacuum tubes gets old or discharged, it will be necessary to increase the rheostat dial reading lightly. When a new or recharged battery is put into use, turn the rheostat down again.

The methods for tuning a reflex set apply to the six-tube portable radio-frequency sets and similar receivers. These types are operated under the same general principles — the only difference being that in reflex sets certain tubes are arranged to do double duty. In some of the reflex sets, an additional element of tuning is introduced through the use of a crystal detector.

The majority of receivers of the types mentioned above employ a loop of wire in place of the usual aerial and ground connections. For these the operators must have a fair knowledge of the compass points about their homes. With this knowledge they will find the following little tip of much value in tuning in distant stations, because it is very necessary that the edge of the loop be pointed directly toward the station they desire to hear.

TAKE a map of the country. On it spot your location. On most maps you will find an arrow at the top indicating north. Now get a little pocket compass and lay it on the map so that its needle points in the same direction as the arrow on the map. It then will be an easy matter to find the exact direction of the different stations within range of the set.

When searching for one of these stations, the first thing to do is to turn the loop so that its edge points in the right direction. Tuning the receiver to its correct wave length will follow after.

Most reflex sets have the following dials: One marked "Tuning" or "Wave length," another marked "Vernier," a third marked "Rheostat," and a fourth marked "Potentiometer" or "Volume." Where a crystal is employed, make sure that the delicate wire is resting on the surface of the crystal in the manner described under the directions for operating a crystal set.

As soon as the rheostat, or battery switch, has been turned on, it will be observed that there is a grinding noise in the loudspeaker if the potentiometer dial happens to be all the way over to one side—usually the left side. This dial should be changed slowly until the noise disappears. Now turn the wave-length dial very slowly until some station is heard. It may be quite possible that the receiver will whistle just as a regenerative receiver does when badly adjusted. In this case a slight adjustment of the potentiometer dial will remedy the trouble. When a station has been brought in, move the dial marked "Vernier" until the signals are loudest and clearest. A little more adjustment on the potentiometer dial will remove any mush or distortion. As a general rule, this dial should be left in that position, but in bringing in distant stations it may be necessary to advance it a little toward the side that eventually brings on mushiness.

In all radio receivers, irrespective of type, where vacuum tubes are used, the rheostat dials should be adjusted so that the lights are burning as dimly as possible consistent with clear, undistorted music or speech. This is a matter of economy to yourself, as well as a controlling factor in the degree of enjoyment you will get out of your set.

The majority of neutrodyne receivers have three large dials on the panel, although a few this year have only two. The tuning directions, however, apply to both types. In addition to the large dials, there are two or more rheostat dials to control the brilliancy of the tubes.

For most veteran radio fans the neutrodyne set is difficult to tune because there are no familiar noises to guide them. The tuning, however, is simple enough if the following rules are observed. It will be found in most cases that the three dials are almost identical in their settings for any particular station. The best way for the new fan to proceed is as follows:

START with the second and third dials at the same setting, both at 55, for example. Now move dial No. 1 slowly between 50 and 60. If no signal is heard, move the second and third dials another degree either way, and then move the first dial over 10 degrees. Some station soon will be heard, and maximum signals can be obtained with slight adjustments on all three dials. As soon as the station has been identified by its call letters, write down on a piece of paper the figures of each of the three dials at which it was heard. When you desire that station again, just set the dials at those figures, and if the station is on the air and conditions are favorable, it will come in. The procedure in picking up distant stations is exactly the same.

ONCE four or five stations have been located, there is a simple method shown in the chart on page 83 by which new stations can be found without difficulty. This method can be used for any type of set.

Like all other sensitive receivers, the neutrodyne will, under certain circumstances, bring in atmospheric disturbances while you are listening to distant stations. If these static disturbances are very bad, they can be counteracted somewhat by slightly detuning the third dial either above or below the correct figure.

There are two types of super-heterodyne receivers in use. First, the home-built or built-to-order type, which ordinarily employs eight tubes; and, second, the factory-built receiver with six tubes. There is an important technical difference between the eight- and six-tube sets.

(*Continued on page 159*)

**How to Set Your Loop Aerial**

On a map of the United States spot your location. Then place a pocket compass on the map and adjust so that the compass needle points in the same direction as the arrow on the map indicating "north." It will then be easy to turn the edge of the loop in the direction of the broadcasting station you want to hear

# How to Do Good Soldering

## The Easiest and Quickest Way to Make Radio Connections

By John Carr

ONE of the main reasons why so many of the manufacturers of radio parts are fitting their instruments with solder lugs is because soldering is the easiest, quickest, and best way to make electrical connections.

Beginners are inclined to doubt this fact after their first session with a soldering iron chiefly because they do not know how it should be done. And the matter of proper equipment is vital, for even an expert cannot turn out a good job of soldered wiring if he has not the right material to work with.

Really, there are just three essentials to good solder work of the kind required in radio construction. They are: A soldering copper (often called "soldering iron," although it is always made of solid copper) heated to the proper temperature, high grade strip solder, and a paste or other flux that will make the solder flow over and form intimate contact with the surfaces of the metal parts to be joined.

Figure 1 illustrates all the equipment you need. An electrically heated soldering copper is not necessary—just as good work can be done with the old style soldering copper, but an electric outfit saves the time that otherwise would be wasted in waiting for the copper to heat up between connections and also eliminates many trips back and forth to the kitchen range.

THERE are several kinds of soldering paste on the market and most of them are excellent, but any brand that contains acid should be carefully avoided in electrical work because of the danger of short circuits and corroded connections.

Strip solder is easier to work with than the kind that comes in solid bars, especially for electrical work where small coppers ordinarily are used. Bar solder will cool the copper before the solder melts from the end of the bar.

Solder should be made of equal parts of tin and lead, but unfortunately a great deal of solder sold today contains very little tin. Such solder does not flow easily and is difficult to work with. Tin is more expensive than lead, which accounts for the lack of it in cheap solder. Be sure that the solder you buy is of the best grade.

Another form of solder that is much used in electrical work is the rosin-core solder. It consists of a small tube of solder filled with rosin, which acts as a flux and eliminates the need for a separate flux or paste. It makes an ideal joint for electrical use, but requires a somewhat hotter iron than many of the other fluxes.

The type of pliers shown in the illustration is not necessarily the best; any pliers that will cut wire and hold it in position while soldering will do.

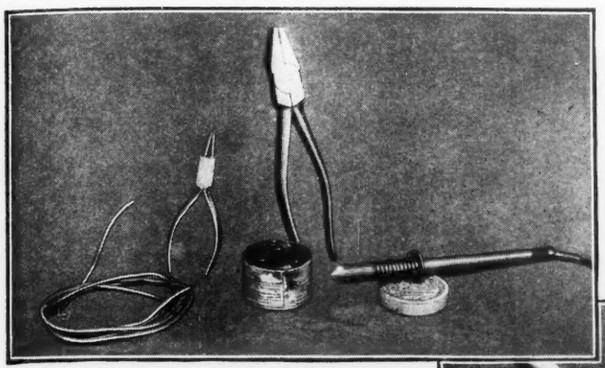


Fig. 1. The equipment you need for a good soldering job (at left) includes strip solder, paste, pliers, and a soldering copper. The copper shown is electrically heated, but the old style works as well

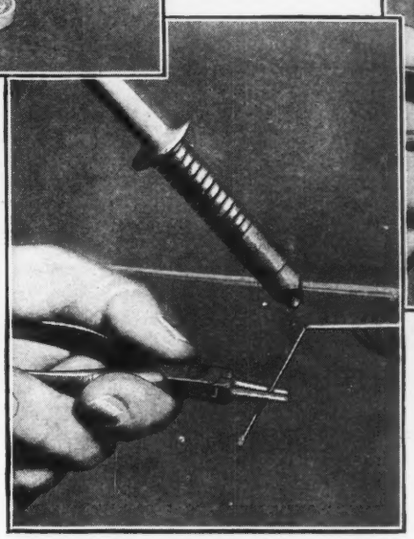


Fig. 2. Soldering a joint. Hold the ends of the wires together and touch the joint with the drop of solder on the end of the copper

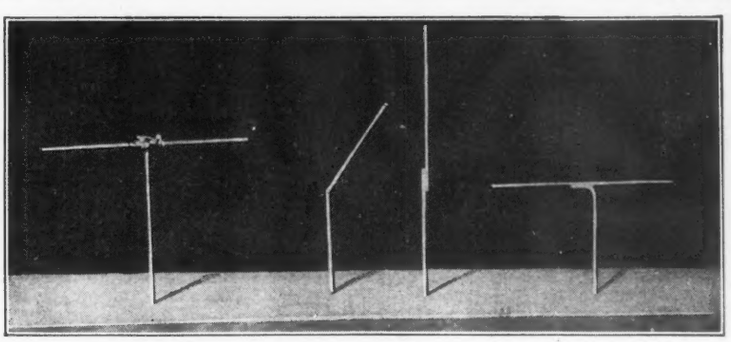


Fig. 4. Four kinds of soldered joints. The one at the extreme left shows how *not* to do it. The second from the left is the joint made in Figs. 2 and 3. The third and fourth joints show how the wires should be overlapped if they are to be subjected to strain. Notice how neatly the joints can be made with practice

ASSUMING that you have purchased the necessary equipment, the first step is to prepare the copper. This process is known as "tinning." If the end of the copper is not clean and shiny, it should be made so with a file. It should then be heated to the point where it hisses when jabbed into the soldering paste. Stick it in the can of soldering paste several times and then rub the end with the strip solder until the surface is covered with a smooth coating of solder that closely adheres to the metal. The best test for tinning is to rub the end of the soldering copper on a piece of woolen cloth and if the solder cannot be removed, the copper is properly tinned, as shown in Fig. 1.

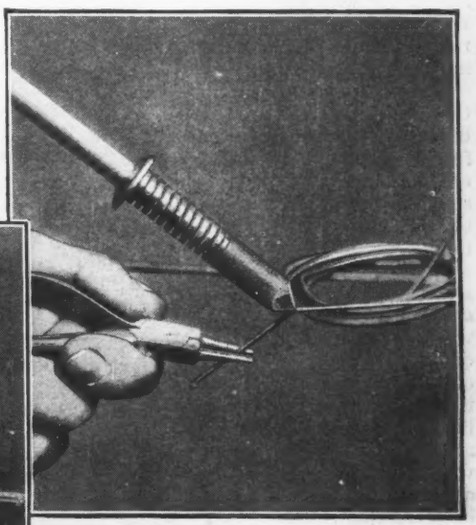


Fig. 3. Completing the joint. Hold the end of the copper on the connection until the solder flows into the joint and over the ends of the wires

Before you actually start to solder the connections in the radio set you have just built, it is a good plan to practice a bit on short lengths of bus wire until you have mastered the knack of it.

If you are using soldering paste, dip the ends of the wires to be joined in the paste. Now melt enough of the solder on the tinned portion of the copper to form a small drop on the end. Next, hold the ends of the wires together, and touch them with the tip of the copper so that the drop of

(*Continued on page 160*)

# A Four-Tube Set to Fit Your Phonograph Cabinet

## How to Build an Economical Receiver of Unusual Tone Quality

By Alfred P. Lane

HERE is a radio receiving set arranged so that you can fit it in the record compartment of almost any standard phonograph. And it is a set that is well worth building, because it combines sensitiveness and selectivity with ease of control and the finest possible reproduction of broadcast music and speech.

The circuit is the familiar three-coil regenerative detector plus one stage of transformer-coupled audio-amplification and two stages of resistance-coupled audio-amplification.

Radio fans who never have tried resistance-coupled amplification will be astonished at the quality of reproduction of this receiver. There is no difference whatever between the first stage and the last stage in the way of tone or clearness, and with 90 volts of B battery, the volume on local stations with four tubes going is too great for most loudspeakers.

and these are well covered by the dials.

The low-loss idea has been carried out in the design of the detector-circuit wiring and in the elimination of special mountings for the coupling condensers, the tubing. Tuning is simple, for there are only two dials and the control of regeneration need not be particularly critical except on distant stations.

The set also is economical to maintain, because it is not necessary to keep all the tubes going when you are listening to programs from local stations. The use of three switches gives you all the power you need for various conditions. The series connection of the switches prevents leaving one or two tubes burning in your absence, for the right-hand switch *R1* cuts off all the tubes, regardless of the position of the two other switches.

A RHEOSTAT in the filament circuit of each tube makes it possible to operate the tubes at the lowest possible temperature consistent with full volume.

The receiver is arranged to use 6-volt storage-battery tubes of

The four-tube set completed and installed by Mr. Lane in a phonograph cabinet. This is the set he tells you how to build in the accompanying article. It is now in the home of Robert S. Dietrich, of Brooklyn, N. Y., who is shown tuning it to a distant station

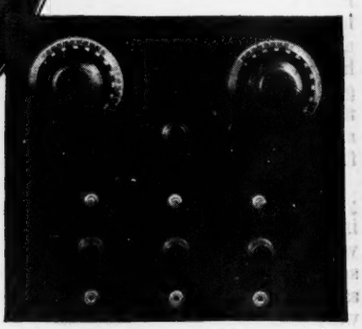


Fig. 3. The symmetrical layout of the front panel, showing wave-length dial (upper right), regeneration dial (upper left), rheostat knobs, jacks, and switches

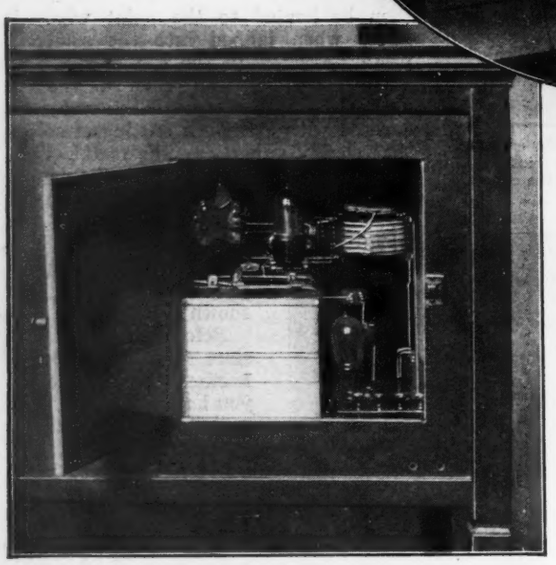


Fig. 1. The door cut in the back of the cabinet. Notice how the B batteries are placed at the back of the set

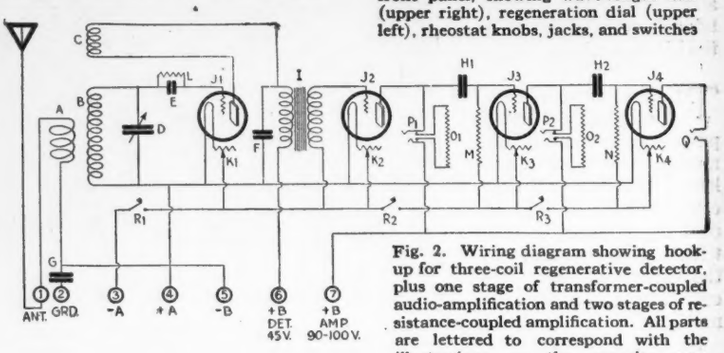



Fig. 2. Wiring diagram showing hook-up for three-coil regenerative detector, plus one stage of transformer-coupled audio-amplification and two stages of resistance-coupled amplification. All parts are lettered to correspond with the illustrations on the opposite page

The construction includes several new wrinkles in wiring and in the elimination of unsightly screws. In fact, there are no screw holes whatever in the front panel *S*, except those used to support the variable condenser *D* and the tuning unit *A*, *B*, *C*, plate resistances, and the grid leaks. The wiring has been reduced to the simplest possible form by the arrangement of the parts in the set and by placing all of the battery and filament wiring under the sub-panel *T* and incasing it in spaghetti

the usual ¼-ampere type. Dry-battery tubes of either the 1½- or 3-volt type can be used without changing the set, unless you use rheostats that are suitable for only one type of tube, in which case the rheostats will have to be changed.

The large-capacity condenser *G* is included in the circuit so that the A or B battery may be charged by any type of charger without danger of blowing the fuses.

## THE PARTS YOU WILL NEED

*A*, *B*, and *C*—Low-loss tuning unit
*D*—Low-loss variable condenser, .0005 microfarad
*E*—Grid condenser, .00025 microfarad, with clips for grid leak
*F*—By-pass condenser, .0005 microfarad
*G*—By-pass condenser, .5 microfarad
*H1* and *H2*—Coupling condensers, .012 microfarad (two pairs of .006-microfarad fixed condensers with solder lugs)
*I* — Audio-frequency transformer
*J1*, *J2*, *J3*, and *J4*—Standard vacuum-tube sockets
*K1*, *K2*, *K3*, and *K4*—Rheostats for ¼-ampere, 6-volt tubes
*L*—Grid leak, 2 megohms
*M*—Grid leak, 1 megohm
*N*—Grid leak, .5 megohm
*O1* and *O2*—Fixed resistances, 100,000 ohms
*P1* and *P2*—Double-circuit jacks
*Q*—Open-circuit jack
*R1*, *R2*, and *R3*—Battery switches
*S*—Panel, 13 by 14½ inches
*T*—Sub-panel, 7 by 13 inches
*U*—Sub-panel, 2¼ by 4 inches
Two brass right-angle brackets, two 4-inch dials, 7 binding posts, 4 tubes, screws, bus-wire, etc.

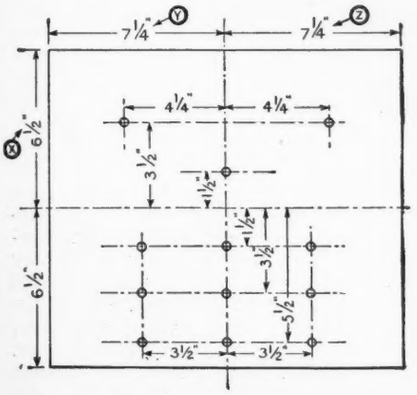



Fig. 5. Diagram showing measurements for the panel layout. The measurements for *X*, *Y*, and *Z* may be varied to suit the size of the particular type cabinet you use

The tuning unit, *A*, *B*, *C*, can be bought complete, or you can build it yourself. The primary, *A*, consists of 6 turns of No. 14 bare copper wire, 4 inches in diameter and spaced ¼ inch between turns. The secondary, *B*, is 47 turns of No. 16 double-cotton-covered wire wound around 15 pegs set in a 3¾-inch circle by the around two, skip two method described in POPULAR SCIENCE MONTHLY for January.

THE tickler coil, *C*, was wound around 15 wooden pegs set into a wooden hub 1½ inches in diameter, with 44 turns of No. 20 double-cotton-covered wire. The coils are held in place by clamping between strips of bakelite. The shaft for the tickler coil, *C*, is a ¼-inch bakelite rod, so that no metal is used in the construction of the tuning unit except the small screws.

Any good make of low-loss condenser may be used, but the capacity should be .0005 microfarad if a secondary coil such as described is used. It is extremely important to use a high quality audio transformer, since the advantage of resistance coupling is lost if the audio transformer in the first stage produces an appreciable degree of distortion.

Any of the standard makes of switches, rheostats, or sockets may be used, but the jacks should be of the type shown in this set, since the frames of the jacks are used to support the sub-panel *T*. There are a number of makes of this general type.

Any make of fixed resistances and grid leaks may be used, provided they are of the correct value. The front panel of this particular set was made of mahogany-finished bakelite, but that is a matter of personal choice—any material will do, provided it is stiff enough to hold the entire weight of the set, which is supported on the front panel.

THE size of the front panel *S* is 13 by 14½ inches, but these dimensions can be altered to fit the size of the record compartment of the phonograph. Because of this possible variation in the panel size, the spacing of holes in Fig. 5 and the layout for panel *S* are given from the center lines, and any changes in the panel size should be in dimensions *X*, *Y*, and *Z*. The panel, of course, can be made as large as necessary, and if 3-inch dials are used, 1 inch can be subtracted from dimension *X* and ½ inch from dimensions *Y* and *Z*, making a minimum size of 12 by 13 inches.

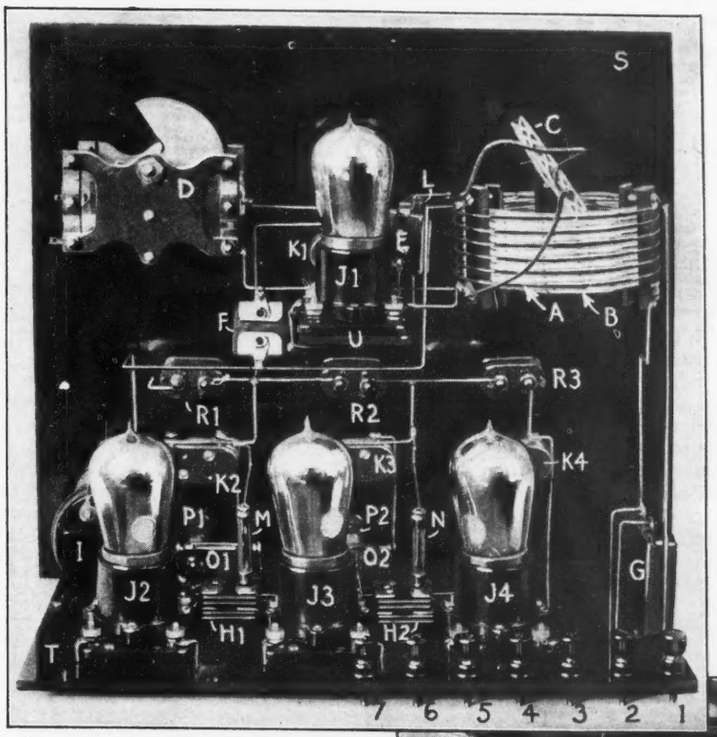



Fig. 4. Rear view of the complete set (above), showing layout of parts and wiring. All parts are lettered to correspond with the wiring diagram on the opposite page. The wiring of the set is unusually simple if the instructions are followed out carefully

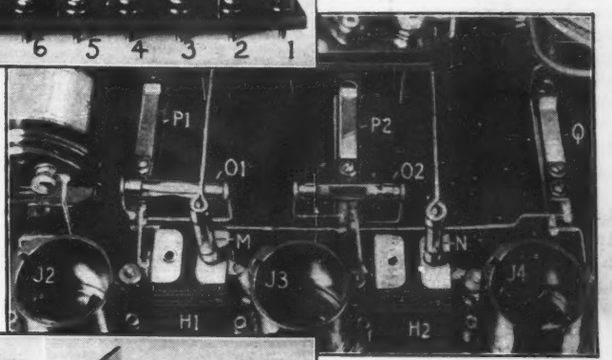



Fig. 6. Details of the resistance coupling, showing how coupling condensers, plate resistances, and grid leaks are arranged compactly on resistance-coupled stages

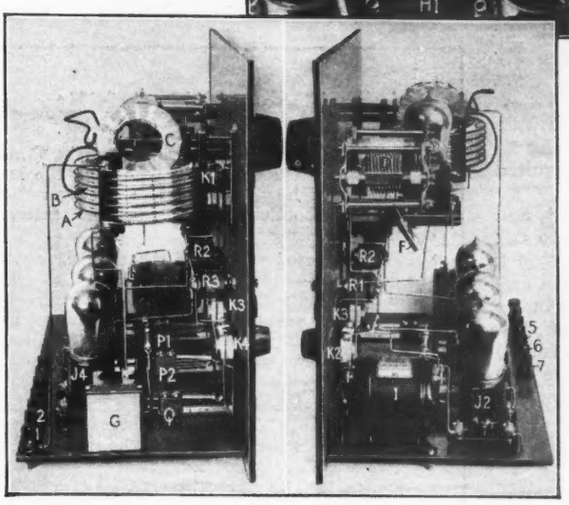



Fig. 7. Left-hand view Fig. 8. Right-hand view

## HOW TO BUILD THE RECEIVER

After you have purchased all the parts, the first step is to cut the panel *S* to a size that will fit the record compartment of the phonograph cabinet.

Now, cut out a paper pattern the exact size of the panel and paste it to the panel with library paste. Measure off the positions of the holes on the paper. Note that only the centers for the shafts are given, because many standard instruments are single-hole mounting and the others vary considerably as to the location of the screws for mounting.

After you have the centers of the shafts located, use the paper templet that comes with each instrument requiring mounting

(Continued on page 162)

# How Radio Gyps Duped Me

## The Story of a Victim Who Built a Set of Junk

*As Told to Newton Burke*

AS A radio fan, I am no longer a beginner—at least I have reached a point in my pursuit of the mystery of radio where I find a little less mystery and hear a little more radio.

It all began during what might well be called the gold-rush days of radio, when the craze had obtained its first hold on the imagination of the public. Hordes of newly made radio fans fought madly at every radio-store counter for the small consignments of parts that came in from manufacturers buried in a sea of rush orders.

The radio craze first hit me one Saturday afternoon. It all seemed so delightfully easy. All you had to do was to string a wire on the roof, connect some wires to various apparently simple electrical instruments and, presto! Music would flow into your ears from all over the country.

By Monday morning I was firmly determined to acquire a radio outfit before another day had passed. As soon as I could, I headed for the nearest radio store, where I mentioned humbly that I was interested in buying a radio set.

"Do you want one of the cat-whisker type or would you prefer an audion detector?" the clerk inquired condescendingly.

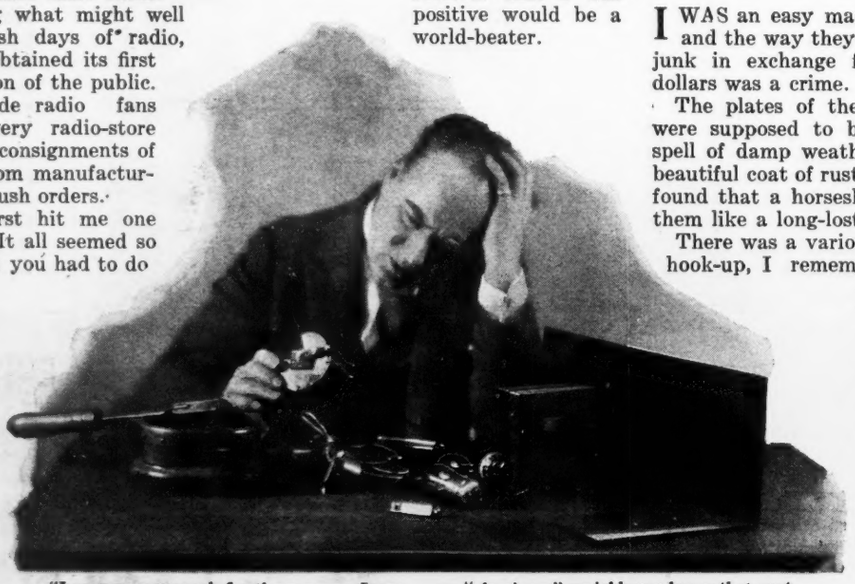
That dazed me for a moment, and then I recovered sufficiently to ask the price of each type. It developed that the set which I understood employed part of a cat would cost in the neighborhood of $25, while the set using the other device would run to all of $75, including the storage battery and the various accessories, which the clerk assured me were quite necessary.

I PAID $25 for the cat's whisker and what went with it, and spent the whole evening installing the outfit according to the alleged simple direction sheet.

Yes, it worked—I lived less than a mile from old WJZ, which was then located in Newark, N. J.; but somehow the tuning lever did not seem to be of much use. If WJZ was broadcasting, I could always get the station most anywhere on the dial, and if it wasn't, no amount of tuning would bring in any other station.

For several months the crystal outfit kept me satisfied. Then I began to long to hear distant stations. That meant a tube set, so I read all the radio literature I could find and wasted reams of paper drawing diagrams of the wonderful receiving set I was going to build.

Finally I worked out the plans for a receiver that I was positive would be a world-beater.



"I was an easy mark for those gyps. In exchange for my hard-earned dollars they handed me parts that were almost useless—an "aluminum" variable condenser that rusted, a variometer that melted in the sun, and a tube socket that broke when I tapped it"

### The Proof of Reliability

IN OUR December issue appeared the Confessions of a Radio Gyp, who told the inside story of how the cheaters among radio merchants "bootleg" tubes, fake condensers, coils, and other apparatus.

Here is the other side of the same story—the confessions of a fan who was duped by the radio gyps and who paid dearly for his experience. What he says should prove helpful in pointing out the pitfalls and swindles in the path of the man who is just starting in radio.

By stamping its seal of approval on the products of reliable radio manufacturers, the Popular Science Institute of Standards is helping to force the gyps out of the radio field; so that the day is not far distant when the novice, as well as the expert, will be able to buy sets and parts with the assurance that they are reliable. In the meantime, the beginner will do well to stick to manufacturers and dealers who have established reputations for honest merchandise and fair play to the buyer.

By this time a change had taken place in the radio market. The tremendous demand, coupled with the inability of the legitimate manufacturers to fill the orders, brought a lot of fly-by-nights into the game with plausible-looking substitutes for almost any of the standard radio parts. That these "gyp" parts were almost useless goes without saying. I know, for that wonderful first set of mine was made of them—all but the panel, which really was made of the material advertised on the sign.

I WAS an easy mark for those "gyps," and the way they handed me absolute junk in exchange for my hard-earned dollars was a crime.

The plates of the variable condenser were supposed to be aluminum, but a spell of damp weather left them with a beautiful coat of rust, and subsequently I found that a horseshoe magnet stuck to them like a long-lost brother.

There was a variometer in the original hook-up, I remember, and it looked pretty good when I bought it; but I left it standing in the hot sun for several hours one day and the whole business actually softened and sagged out of shape so I could no longer turn the rotor. The tube socket, too, was an excellent example of "gyp" manufacture. I think it was made of the same material they use for molding the clay disks that trap-shooters aim at with shotguns. Certainly it was brittle enough—my screwdriver slipped while I was assembling the set and struck the side of the socket a very gentle blow, whereupon a large piece dropped out.

Really, it was a tribute to the broadcasting stations in operation at the time that the set brought in anything at all.

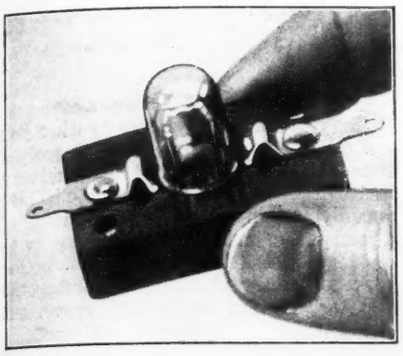
I COULD go on and tell, part by part, just how each instrument finally revealed itself as a fraud and had to be replaced with the genuine article. Eventually, the whole receiver was rebuilt.

The matter of "gyp" parts no longer bothers me, for I have learned to know genuine parts when I see them and I am familiar with the trademarks of most of the reliable manufacturers. Still, it was a pleasure the other day to note, as I walked by the store where I bought my first set of parts, that the "gyp" who ran the place finally had gone to the wall and that an auction sale was being held under the unfeeling direction of the sheriff.

For the sake of all those who are just starting in the radio game now, it is a pity that many of the "gyp" fraternity are still in business. Doubtless there are still thousands of beginners who will have to learn by experience as I did.

# The Month's Curiosities in Radio

## A Multiple Hook-Up—Unusual Sets and Accessories

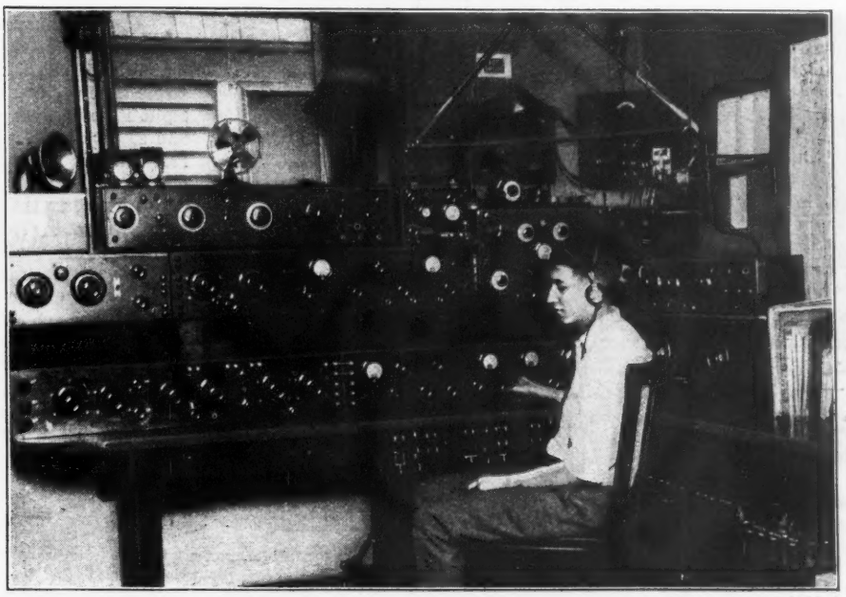


### Fuse Protects the Tubes

It is connected in the minus B battery line and will burn out instantly when the current rises to between 140 and 200 milliamperes, so that if the high-voltage wires in the receiver become crossed with the filament circuits, or the B battery is accidentally connected in place of the A battery, the fuse will burn out and the tube filaments will not be injured at all

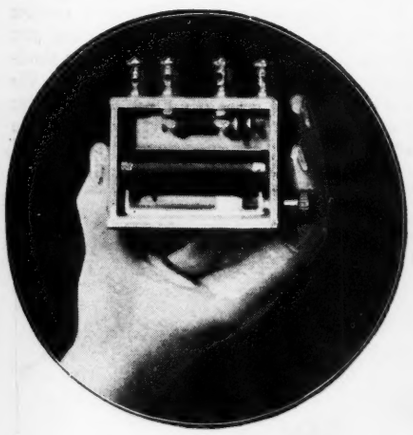
### This Fan Tries Them All

According to Peter Testan, Jr., of Brooklyn, N. Y., the only way to find out which type of receiving set gives best results is to test them all under exactly the same conditions. In his laboratory shown below, he has an elaborate collection of radio receivers, including nearly all of the popular types. A switching arrangement permits him to shift instantly from one set to another so that he is in a position to judge value in the reception of distant and local stations



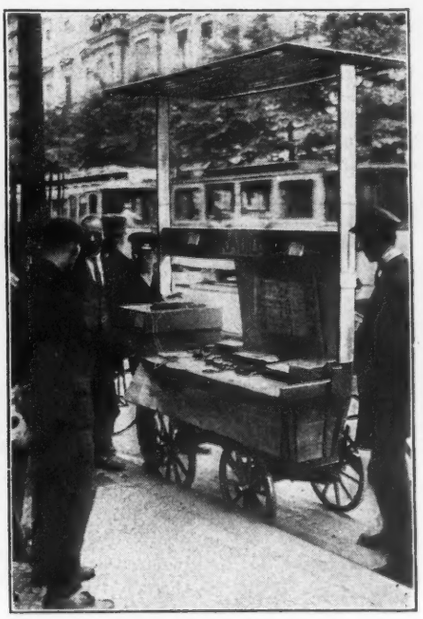
### Old Shoe Houses Radio

Here is a perfect receiving set, built in an old shoe by Elaine Rabinoff, which carried off a prize in the novelty class at the recent radio show in Chicago. It is a crystal receiver, and on test showed efficiency about equal to similar small crystal sets built in a more conventional form. Notice the tuning dial at the side of the shoe near the heel, and the binding posts for buttons



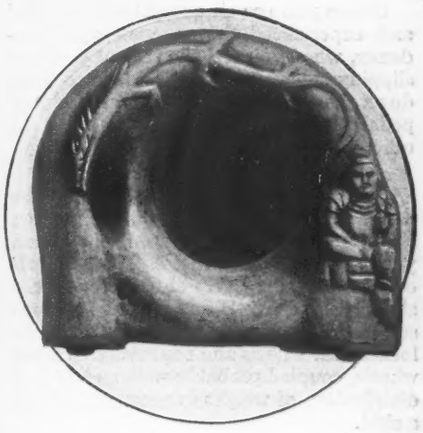
### Radio Set in Vanity Case

Another of the novelty receivers at the Chicago Radio Show was built into a vanity case after the powder puffs, powder compartments, and the other usual fittings were removed. It is a crystal receiver. The tuning inductance is shown at the bottom and the four binding posts at the top are used to connect the set with the antenna, the ground, and the head phones. The picture shows it removed from the case



### The Radio Peddler Appears

In many foreign cities, the peddler's pushcart loaded with an assortment of the cheaper radio parts is a novelty



### Loudspeaker like Throat

A loudspeaker that is designed after the human throat and its adjacent passages has just appeared on the market. In addition to the main channel for the sound, there are other passages in the molded composition that the inventor claims add much to the naturalness of reproduction. An artist and a sculptor assisted in working out the final design of the instrument so that an attractive and ornamental loudspeaker is the result

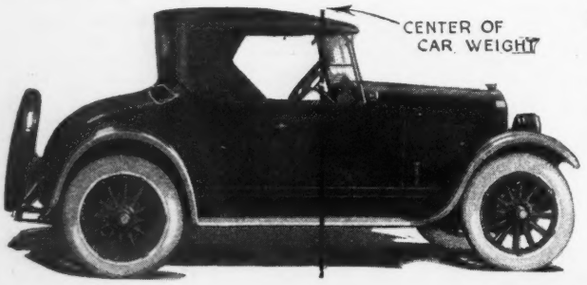
# SKIDDING—How to Avoid It

## An automobile expert tells of simple ways to save your car from disaster on treacherous roads

By George Arthur Luers

A LIGHT car and a heavy foot make a combination that works well as long as you traverse dry and unobstructed concrete roads.

But when the roads are glazed with ice, when they are wet from snow or rain, when they are freshly oiled, when a light rain has converted the fine dust on old roads into slippery mud, when you attempt to avoid a stretch of bad going by driving on wet trolley tracks — then this combination is likely to prove dangerous; for it leads to skidding.



CENTER OF CAR WEIGHT
THE HEAVIER THE REAR OF THE CAR, THE GREATER THE TENDENCY TO SWING, REQUIRING CAUTIOUS STEERING AND REDUCTION OF SPEED

In fact, the heavy foot that always presses the accelerator down to the limit and suddenly jams on the brake every time it is necessary to stop, is a dangerous thing to have in any car on any kind of highway.

Unless you are an exceptionally skilful and experienced driver, your first tendency, when you feel the rear of your car slipping sideways into a skid, is to push down hard on both brake and clutch pedals. You want to stop the car as quickly as possible.

A SKIDDING car, however, can't be stopped with its brakes. When you throw out the clutch and apply the brake, you lock the rear wheels. The wheels cannot rotate, the grip of the tires on the slippery roadway is slight, and the consequent difference in traction between the locked rear wheels and the revolving front wheels, coupled probably with an unequal distribution of weight in your car, causes a skid.

One fact must be appreciated by every owner—that no car has ever skidded without cause and the driver is almost invariably the contributor of the cause.

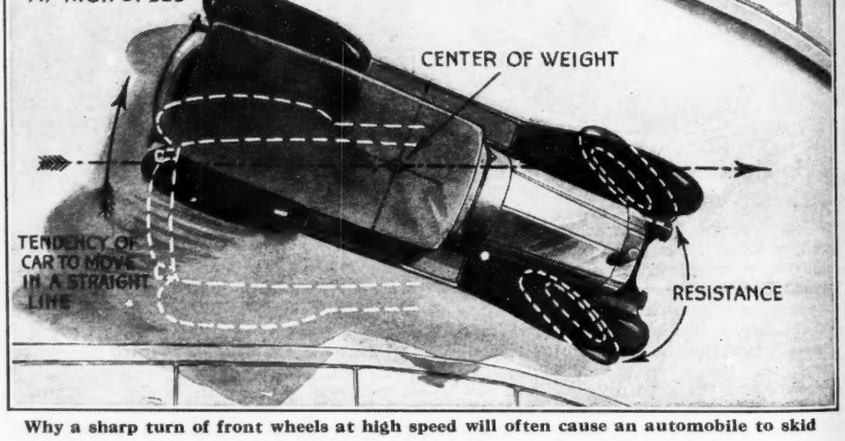
Underlying many instances of serious skidding is the nervousness of the driver. The terror of the sudden side swing robs the driver of his ready reasoning power, and a movement of the foot or hands brings on the skid with uncontrollable suddenness.

The thing to do is to drive slowly always on slippery roads—on any sort of roads, for that matter. Then the necessity for making sudden stops—one of the most frequent causes of skidding—will be removed. Also, the skilful driver will control his car speed mainly with the engine, closing the throttle or even shifting into a lower gear and using the throttle to slow down under adverse road conditions. If this does not control the car, it is permissible to apply the brake, without releasing the clutch, which keeps the wheels rolling in a definite direction.

Avoid driving directly to a curve at high speed or abruptly around another vehicle. Instead, learn to reduce your speed with the throttle a considerable distance in advance of the turn, and then make as wide a turn as possible. A good rule to remember is to make the movement of your steering wheel always proportionate to the speed of your car. You can turn the wheel halfway round in perfect safety when you are going slowly, whereas at high speed a sixteenth of a revolution of the wheel may invite disaster. The wheel should be held steadily and any suddenness in change of direction avoided. It is not necessary to coast around a turn; in fact, it is better to keep the clutch engaged, closing the throttle to retard the forward movement of the car.

THESE precautions should be sufficient to prevent your skidding in the ordinary conditions of driving. Should the car skid, though, despite all your efforts to be careful, you can right it, or help to right it, by turning the steering wheel in the same direction as that in which the rear end is slipping. It is evident, of course, that this procedure may necessitate steering toward a ditch, when the rear swings in that direction; however, this is a consideration that makes it more necessary to take the curve cautiously at a safe speed.

Skidding at curves applies to both wet and dry road conditions. A straight road, of the crowned, or raised center variety, also can contribute to skidding even in dry weather. Ordinarily in driving along such a road you will straddle the crown instinctively in order to keep the car level. Sometimes, though, it will be necessary for you to turn out to permit another car to pass. Then look out for skidding! Slow down always when you leave the crown, for obviously the slanting car tends to slide over toward the ditch. So slow down, go into low gear until you are back astraddle of the crown again. If necessary, stop, and




Why a sharp turn of front wheels at high speed will often cause an automobile to skid

then make your way back to the center of the road as cautiously as you can. If the road is of clay, and wet, take even greater precautions than those I have suggested.

Too much weight in the rear of the car contributes much to skidding. Closed cars likewise are more likely to skid, on account of the distribution of the weight, than open models, especially roadsters. If you study the movement of your car along the road, it will be evident that the farther forward and the more evenly distributed the load is, the more responsive the car will be to steering. When the most weight is over the rear wheels, the steering wheels, even though inclined in the desired direction, cannot readily control the weight to the rear of them. With the rear wheels locked and no defined direction of travel maintained by them, the heavy rear weight tends to take control over the front of the car.

POSITION ON CROWNED ROAD WHERE USE OF BRAKE IS DANGEROUS
OVER THE CROWN THE HEAVY REAR OF CAR SEEKS THE DITCH
CROWNED ROAD

THIS condition will be evident, especially when a car is proceeding on the side incline of a wet road. The locked rear wheels are restrained against forward movement, and obviously they cannot slide up toward the crown of the road. There remains but one thing for them to do, and that is to slide down, which they invariably do. The steering or front wheels are not locked and are free to roll forward. The result is that the rear of the car swings around to the front and possibly ditches the car.

It is desirable practice under every condition to carry passengers and equipment well forward in the car. Even spare tires and tools add a desirable forward weight, and the mounting of spare tires on the front fenders or the use of trunks, compartments and storage boxes forward on the runningboards, is more desirable than having their weight at the rear.

Chains, of course, will lessen the likelihood of skidding. These are applied ordinarily only to the rear wheels, but there are extremely wet conditions under which the front wheels will not hold direction, when it is essential to carry chains on all four wheels.

Balloon tires are credited with having less tendency to skid than others. This is probably true, for tires that are not too heavily inflated or tires that are soft, seem to have better tractive qualities. It is possible the greater area of rubber in contact with the road grips the pebbles and projections, thus holding the car fairly steadily, while the high-pressure tire cuts and slips past all projections. One noticeable advantage of the soft tire is that it resists being turned readily from its path or direction of rolling, thus tending to prevent a skid.

In wet-road driving, the foremost precaution is to avoid that sudden change in direction. Fairly good speed can be maintained on the straightaway, but to make an abrupt turn is always dangerous. Under-inflated or balloon tires, both of which resist or restrain the car in abrupt turning, undoubtedly are safeguards. With them the road contact also is better, for the softer tires will not bounce off the road, leaving the rear end free to begin swinging.

Speed on turns is the force behind the skid, and the lower the speed the lower will be the force that inclines to skidding. Any abrupt change in direction, regardless of tire equipment or chains, must be at a slow speed, that the forces stored in the car will be controllable and so reduced that the tires can maintain traction.

IF YOU are inclined toward nervousness and are inexperienced in driving on wet roads, apply chains to all wheels, keep on the crown of the road, and under no circumstances swing the front wheels rapidly, unless the car is moving at a speed below five miles an hour.

The driver who faces the greatest danger of skidding is the one whose car never has skidded and who therefore remains blissfully ignorant of its hazards. He has experienced none of the feeling of absolute helplessness that comes over the man at the wheel when the car slips out of his control.

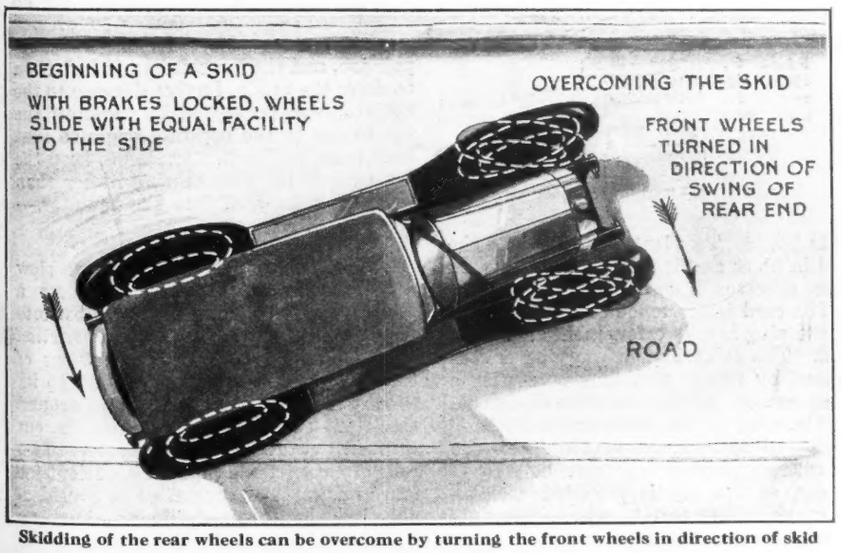
I remember that when I first drove a car all roads were alike to me. Whether they were wet, dry, oily, or dusty, it made no difference—I sailed along just the same under all conditions on the straightaway, and took the turns figuratively on one wheel.

Then one day, when the road was slippery after a slight rain and I was driving along a straightaway at about 35 miles an hour, a coal truck suddenly poked its great nose out of a side street and started to cross directly in front of me. I turned the wheel sharply, at the same instant releasing the clutch and stepping hard on the brake—

I SHALL always remember vividly the sickening sensation as the wheels of my car refused to obey my hand. We spun around, my car and I, missing the truck on one side, and a telegraph pole on the other—by inches.

In less time than it takes to tell it, I had learned my skidding lesson. From that day I have taken no chances, for I know the possibilities of disaster that lie in slipping wheels.

And so, if you are one whose car never has skidded, take my tip and follow the simple precautions I have mentioned. They may save you from one of the costly accidents that bring tragedy to thousands of motorists each year.


BEGINNING OF A SKID
WITH BRAKES LOCKED, WHEELS SLIDE WITH EQUAL FACILITY TO THE SIDE
OVERCOMING THE SKID
FRONT WHEELS TURNED IN DIRECTION OF SWING OF REAR END
ROAD

Skidding of the rear wheels can be overcome by turning the front wheels in direction of skid

**$50 in Prizes**

HAVE you a workbench in your home, and do you like to build useful things?

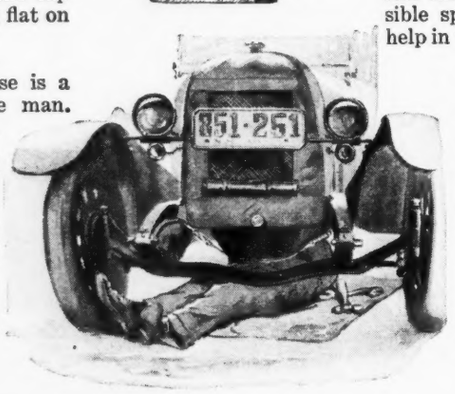
If so, turn to page 130 of the Home Workshop Department. There you will find the announcement of a prize contest that is sure to interest you.

# Saving Auto-Repair Costs

## What the Car-Owner Can Do for Himself

FINDING it next to impossible to clamp a ball-socket cap in a vise for filing, I made a convenient holder out of two old caps and two bolts, as shown in Fig. 1. The old caps are gripped in the vise and the one to be filed is laid over them. If no vise is at hand, the cap and holder can be rubbed over a file lying flat on the bench.—LAWRENCE TORELL.

TO REMOVE or replace a crankcase is a difficult and annoying job for one man. Jacking or blocking up the case helps, but is somewhat awkward and may cause dents in the bottom of the case. A better method is to use a few old springs and two or three lengths of hay-baling wire, or wire of equal strength (Fig. 2). On one job I saved an hour by this means.




If no mud-pan clips are provided, stiff pieces of heavy wire may be bent to the proper shape for attaching the supports and hooked or fastened to the springs or frame. The supports should be of a length to suit the car; the ones I used were 18 in. long. — RICHARD C. TARR.

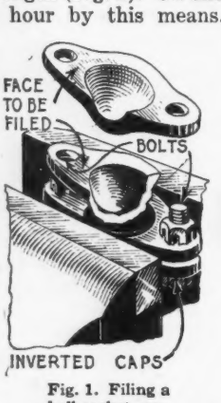



Fig. 1. Filing a ball-socket cap

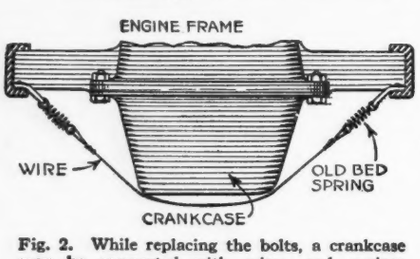



Fig. 2. While replacing the bolts, a crankcase may be supported with wires and springs

FOR giving hand signals at night, the devices illustrated in Fig. 6 are excellent. One is a white disk painted on the left gauntlet; another is a polished disk of white metal, and the third is a small ruby lens, all of which reflect the light from any following car.—A. G.

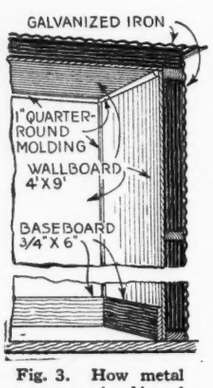



Fig. 3. How metal garage is lined

THE annoying "cracking" and "snapping" of the spokes in wooden car wheels often can be prevented by turning a light spray from the hose on them at intervals to swell the wood. If the trouble is due to drying out of the wood, and not to short spokes or other cause, a permanent cure is made by soaking the wheel in linseed oil, and then painting.

OWNERS of corrugated sheet-metal garages often find that the cold penetrates them to such an extent that it is difficult to start the automobile on winter mornings. In the summer, too, these garages are apt to become very hot, to the detriment of the car's finish, as well as the tires, upholstering, and top.

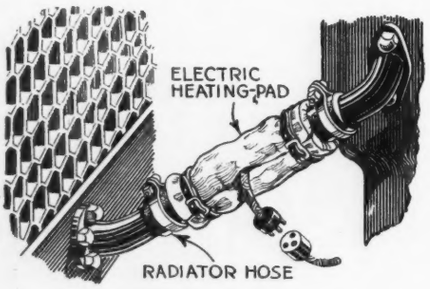



Fig. 4. Heating pad prevents radiator from freezing

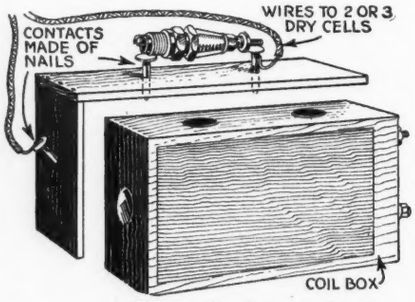



Fig. 5. Simple testing board for auto coil and spark plugs

One construction company, which carefully studied these objections to the otherwise economical, durable, and serviceable metal garage, has developed several types of inside sheathing.

Any handy man, however, can line his garage with easily and cheaply obtainable wallboard. It comes in large sheets and is nailed directly to the studding, as shown in Fig. 3. The corners are finished with quarter-round molding and a baseboard is nailed around the bottom. The cost often can be kept within $15.—GEORGE A. LUERS.

WHEN a garage is wired for electricity, it is a simple matter to wrap a heating pad around the lower hose connection, running from the water jacket of the engine to the bottom of the radiator, as in Fig. 4. Two leather straps hold the pad in place and it may be covered with sheet asbestos, if desired.

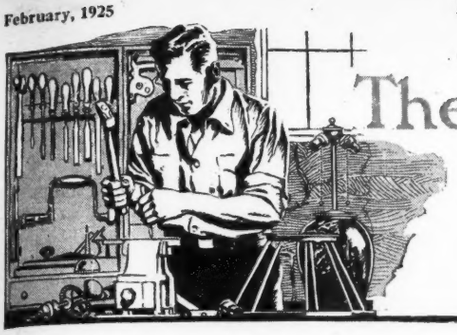
The cord is shortened so that one half of the plug is only a few inches from the pad. The other half of the plug is connected by means of a long cord with a lamp socket. When you drive in on cold nights, plug in the three-way switch on high, low or medium, according to the weather, and your car can be left in safety, as the pad is provided with an automatic thermostat, which prevents overheating.—F. S. ROOT.

Fig. 6. Hand signals for night auto driving

WHILE on the road, the key driving the fan on my light car loosened up enough to allow the fan to slip forward and damage the radiator by constant rubbing. As no one was dressed for a greasy repair job, and the fan belt had to be left on to drive the pump, further damage to the radiator was prevented by twisting the fan blades to the opposite angle so that the "propeller" action tended to keep the fan against the rear bearing rather than to draw it forward into the radiator.—HAROLD E. BENSON.

A RUSTY rim is apt to cause slow leaks in an inner tube unless a "liner" is used. I find a good substitute for a regulation liner is a layer of friction tape wound on the rim. The turns of tape should be overlapped about ¼ in. so as to form a continuous band around the rim, except where a hole is cut through the tape for the tire valve. Two rolls of electrician's tape are sufficient for four rims and, of course, costs considerably less than ordinary liners.—DONALD H. PALMETER.

IN COLD weather a good strong spark is necessary. To insure having one, the tester illustrated in Fig. 5 is valuable. Use it either with dry cells or storage battery while adjusting the vibrator to give a high-pitched buzz and regulate the spark-plug gaps until the strongest possible spark is given. I find this apparatus of help in winter and summer.—CLYDE E. VOLKERS.



# The Home Workshop

Arthur Wakeling, Editor

# How You Can Build a Snow Igloo

## Imitating the Eskimo in Novel Sport for Snowdrift Days

*WITH his right arm afire like a torch, an Eskimo boy burst screaming from a snow igloo. Lieut.-Comm. Green, U.S.N., busy with dog harness near by, seized the pain-crazed lad, smothered the flames, and doctored the burns so skilfully that they healed. In gratitude, the boy's father asked how he could repay so great a debt, for an Eskimo with a crippled hand is doomed to the endless torture of unescapable frostbite. "Show me how to build a snow igloo," was the reply. As a result Commander Green is one of the few white men, if not the only one, who can build an igloo as well and quickly as the most expert of the Eskimos. It is merely a matter of knowing a few simple tricks and these he has described in the following article.*

**By Fitzhugh Green**

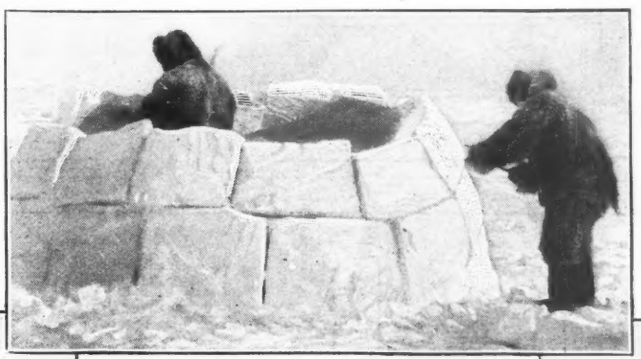
A SNOW igloo in some ways is the most remarkable dwelling constructed by man.

An igloo for 10 people can be built in 45 minutes. No tool is required except a long knife; no material save snow. Once finished, it will support three men on its roof. A cyclone could not demolish it. It is air- and water-tight, sound- and tempest-proof. It is warm, dry, light, durable, well ventilated, and clean. Its door has weather strips, but no hinges. Its window is transparent, but unbreakable. Its floor is marble-white and hard, yet can be replaced in 10 minutes.

Properly initiated into the mystery, any man can build an igloo the first time.

It is important to select proper snow. Find a drift packed hard by the wind. Test it by pushing your butcher knife into it. If the snow yields grudgingly, it will make good blocks.

Cut a rectangle about 2 by 3 ft., slanting a bit toward the bottom. On the edge toward you, gouge out a trough 1 ft. wide and from 6 to 10 in. deep. This trough enables you to slide the knife blade back and forth under the block your vertical cuts have outlined. Dislodge the block by a gentle kick or two in the horizontal crack. The other 50 blocks are easily cut, working from this space.



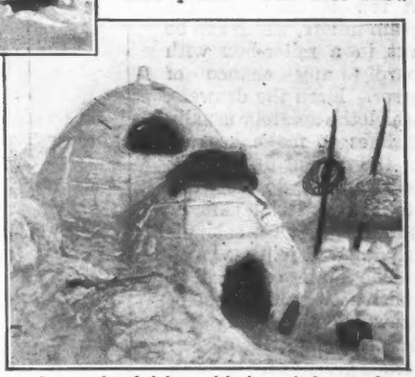
Photos courtesy American Museum of Natural History

Building the walls with blocks of snow joined closely and later welded by heat

Careful fitting of the keystone block insures a self-supporting, blizzard-proof roof

With your heel mark an ellipse 8 by 10 ft. on a smooth packed surface, sloping slightly, if possible, in the direction you wish your igloo to face. Lay a ring of blocks lengthwise, edge to edge, on this outline. As shown in the sketch on page 132, place the last two blocks up-ended at the front right-hand corner. This gives you a starting slope for your spiral when you cut away a triangle as indicated by the dotted line. Start the succeeding row with a full block lengthwise. As you near the back wall, begin to slope the blocks slightly inward.

It is very important that edges be well fitted. An Eskimo does this by shaping his block as neatly as possible before lifting it into place. He then lays it gently on the underneath wall and slides it slowly against the preceding block. Holding it with his left hand he works his knife back and forth between its edges and those adjoining. Gradually it sinks into place. The soft snow powder loosened by his knife becomes, in effect, a mortar. Finally, with a thump of his knife hand, he drives the block firmly and tightly into its resting place.



A completed igloo with ice window and vestibule for sheltering dogs and footgear

Success with an igloo centers in the arch. And success is easy if one remembers the principle involved—that any domed structure is self-sustaining when its parts permit distribution of stress throughout the whole.

No snow block must be laid at an angle that puts its face out of line with the curving spherical surface of which it is an element when the igloo is complete. A few trials will show that as the spiral rises the walls may be sloped more and more sharply inward. Block faces in all cases above the first tier or two are beveled as the cover edges of a hallowe'en pumpkin or a pineapple cheese are beveled. This

(*Continued on page 132*)

### What the Mechanical Departments Offer You

**PAGES 93 to 133—The Home Workshop, with 34 articles telling how to make furniture, toys, household conveniences, and novelties—a handbook for amateur mechanics—illustrated with 38 drawings and 26 photographs.**

**Pages 134 and 135—Shipshape Home Department.**

**Pages 98 and 136 to 146—The Better Shop Methods Department packed with time- and money-saving suggestions for the professional mechanic—17 illustrations.**

**Special Handicraft Contest Announcement on page 130.**

# Beautiful Salem Chest Easily Made

## Has no Difficult Joints to Puzzle the Beginner in Woodwork

IF YOU are a relative beginner in woodwork and wish to astonish your family and friends by building a piece of furniture that will appear to be the work of an experienced craftsman, you cannot find a better project than the attractive Salem chest of drawers illustrated at the right.

Incidentally, few pieces of furniture are more appreciated. In almost every home there is room for another chest of drawers, and just now the low type, developed so beautifully by Colonial cabinetmakers, is becoming exceedingly popular.

A Salem chest of drawers to grace any bedroom

From the standpoint of construction, this piece is entirely unique. It is safe to say that never was designed a chest of drawers so distinguished for beauty and refinement of proportions and at the same time so simplified that it does not require the making of a single difficult cabinetmaker's joint.

There is not a mortised and tenoned, a dovetailed, a tongued-and-grooved, or even a rabbeted joint in the whole piece. Most of the parts are put together with butt joints, such as are used in common boxes. A few of the joints are plain miters, which can be cut in a miter-box with hardly any chance of error. Even the drawers, which the amateur usually dislikes to make because of the careful fitting that is required, do not call for any especial skill or knowledge of cabinetmaking and joinery.

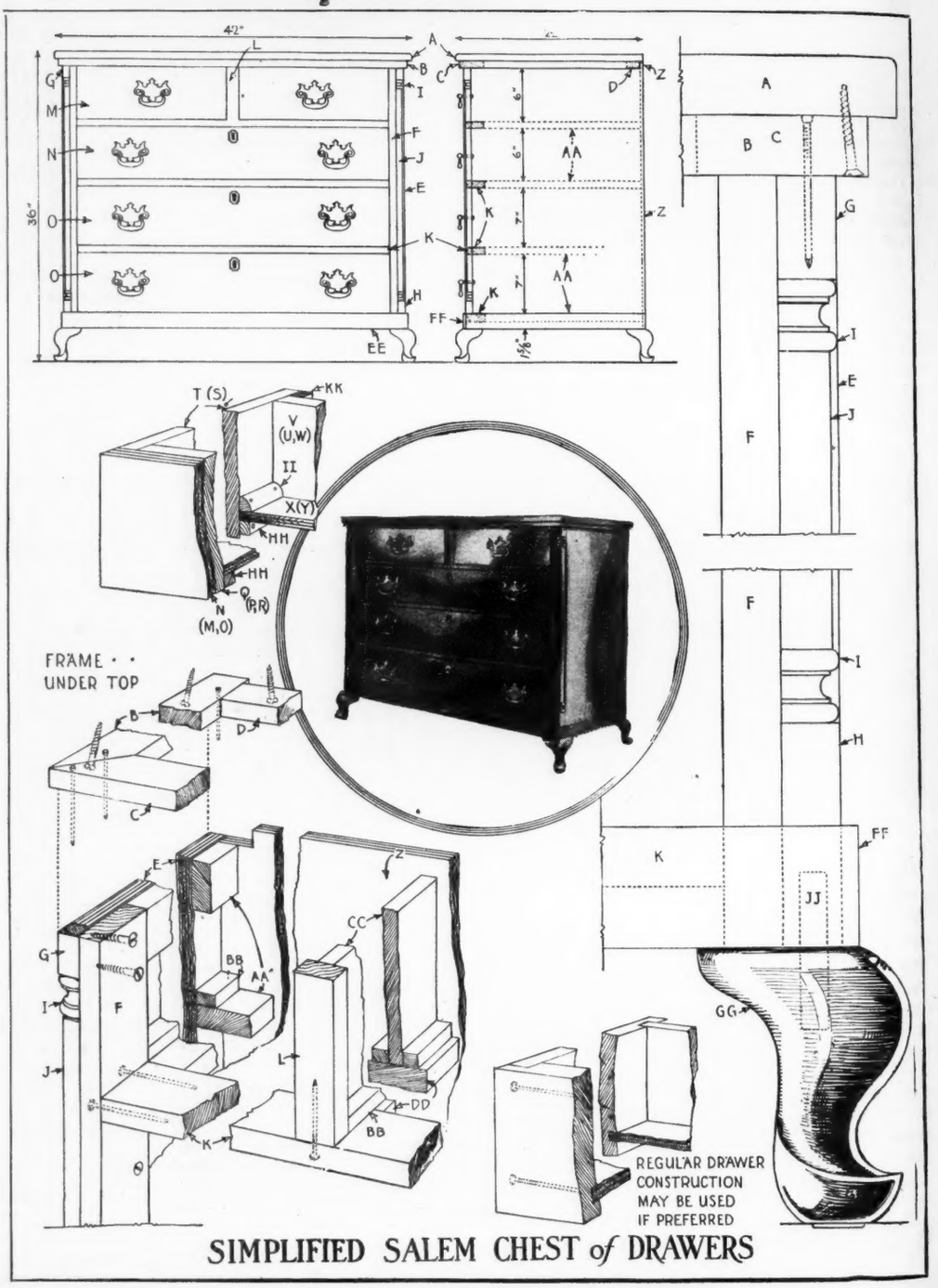
The main essential in constructing this chest of drawers is to study the drawings and bill of materials given later on until you have obtained a clear idea of the relation of the parts. Then buy a sufficient number of boards to make the chest. What you get will depend somewhat upon what your lumber dealer has in stock, but he will be glad to help you select stock that will cut to best advantage. Then cut all the main pieces to the correct dimensions as accurately as possible.

You will find that it is a simple matter to assemble the pieces. It is just like building a house of blocks, because the parts go together naturally. What little fitting becomes necessary as the work progresses, will be child's play in comparison to the work usually entailed in making a piece of furniture.

The exact size of each piece necessary in building this chest is given in the following bill of materials. Each item is lettered to correspond with the accompanying drawings. The dimensions are given in inches. The woodwork can be made of mahogany, gumwood, or any cabinet hard wood you prefer to use, except where otherwise noted.

*A* Top of case, ⅞ by 22 by 42, either solid hard wood or plywood, 1 required.

(*Continued on page 123*)



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*No. 124 Golden Oak*
*No. 160 Brown Oak*
*No. 125 Mission Oak*
*No. 130 Weathered Oak*
*No. 110 Bog Oak*
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This seal on a radio or tool advertisement signifies the approval of the INSTITUTE OF STANDARDS. See page 33.

# Making Removable Seat Cushions

## Easy Ways to Do Your Own House and Auto Upholstering

By William T. Weld
*Shopwork Instructor, Central High School, Peoria, Ill.*

A COMFORTABLE seat with a good cushion is a combination not always encountered. Office workers, draftsmen, motormen, and many others sit on hard stools that would be much less fatiguing if provided with cushions.

It is not always possible, however, to get a cushion that will fit the chair or stool you use. In that case you can make one yourself.

First determine the size, the kind of material you want for a cover, and the kind of stuffing with which to fill it. Figure 1 shows how a pattern is laid out for a cushion 1¼ in. thick and 12 in. square. From this plan you can modify the dimensions to suit your own requirements.

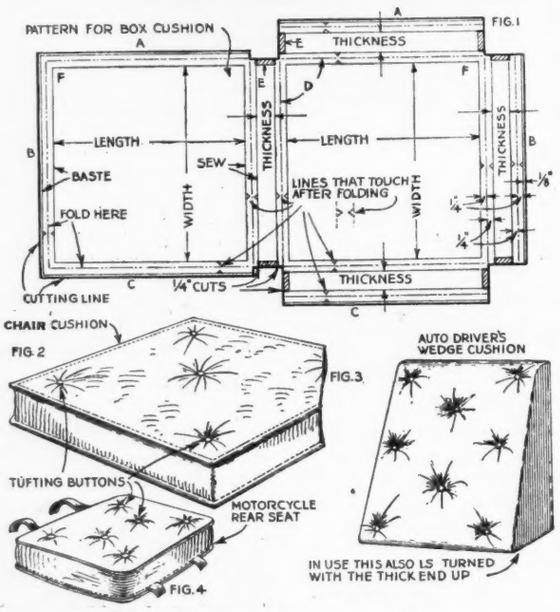
For a cushion that is to have hard and continuous service, a cover of heavy material, such as canvas or artificial leather, should be used, while for porch swings, lawn seats, cedar chests, and the like, a good grade of cretonne will serve.

Curled hair, while the best material for stuffing, is rather expensive, so kapok, cotton or Spanish moss can be used. Moss makes a light cushion, is inexpensive and does not pack down readily from continued use.

No one knows better than Mr. Weld the tricks of doing simple upholstery and chair seating. His next articles will tell how to recane chairs and repair upholstery of various kinds

Tying on a button with a tufting knot (above) and (below) sewing up the stuffing opening

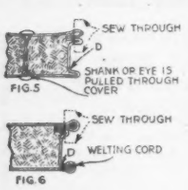
To determine the total *length* of the material needed, add twice the desired length and twice the desired thickness to the sum of the figures representing the amount of material needed for folding in the seams, usually 2¾ in. To determine the total *width* of the material needed, add twice the desired thickness plus the width to the sum of the figures representing the folded material, which in this direction will be 2¼ in.




Pattern for a straight side or box cushion, a removable chair cushion, and motorcycle and auto cushions

AFTER you have your material cut to these over-all dimensions, start from the left edge, *B*, Fig. 1, and measure over as indicated until the right edge, *B*, is reached. A pin may be inserted for reference on each line as it is measured off. Make all your measurements accurately and be sure that all corners are laid off square.

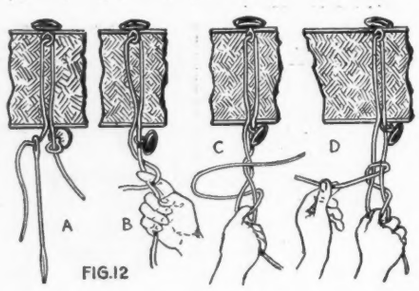
The same procedure is done from edges *C* to *A*. Then cut with a pair of scissors or a sharp knife on all the lines indicated by the heavy lines of the drawing.




Two methods of making the seams

You are now ready for the stitching. The use of a sewing machine makes a neater job, but with a little care and patience a good cushion may be made by hand.

Figure 5 shows how a section of this type of cushion will look. As shown at *D* in Fig. 1 and in Fig. 5, the lower loops or seams are sewed permanently, after being folded properly, while the seams at *A*, *B*, and *C* are first basted or pinned temporarily in the proper position. The purpose of this folding is to conceal the raw edges of the material and to make a finished edge that will wear well. The loop formed also serves to hold welting cord in place if you desire to use it (Fig. 6).




Steps in tying an upholsterer's tufting knot

The seams marked *D* are first sewed, then the vertical sides are folded up and the flaps *E* turned in together, and the corners are stitched from the inside. Next, fold the upper surface (*C*, *B*, *A*) into place, which will take a position so that one *F* will be directly over the other *F*, thus really forming a cloth lid to the box cushion you are making.

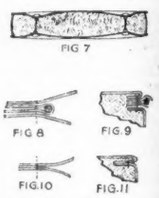
Proceed to stitch this into place, as shown in Fig. 5, and continue around three sides and about two-thirds of the way along the fourth side. The stuffing then is put through this opening, after which it is sewed up.

This method of making a box cushion has the advantage of keeping your material all in one piece and that all of the stitching, with the exception of the vertical corners, is done from the outside.

Figure 8 shows a method used by upholsterers. In this the welting cord is covered first by a narrow strip basted in place, and then stitched between one vertical edge and one surface. These are held together as shown and stitched from the wrong side of your material. This is done at all seams, an opening being left for the purpose of putting in stuffing; then the whole cushion is turned right side out. An edge seam of this type appears as shown in Fig. 9.

FIGURE 10 shows a simpler method, with the cord omitted. The top and bottom pieces are cut to proper size, the vertical edge is cut in one long strip of the proper width and length and sewed together at the end. The edges of adjacent and corresponding surfaces are then placed as shown in Fig. 10 and stitched about ¼ in. from the raw edge. This is done all the way around on both the top and bottom surfaces. The cover then is turned right side out, as explained before. Figure 11 shows how this seam looks when finished and turned.

The stuffing is pushed through the opening left at one edge. Take a small amount each time and work it well into all the corners with a long narrow stick or by putting your arm through the opening and using your fingers.




Details of seams and tufting

Fill the cushion until the center is about twice as thick as you really want it. You are then ready to tie

(Continued on page 122)

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IN CANADA: DIAMOND STATE FIBRE COMPANY, OF CANADA, LTD., TORONTO, CAN.
Made and Printed in U. S. A.
How to Work and Finish Celoron Bakelite Panels
DRAW full size layout of the holes to be drilled on a sheet of heavy paper, cut to exact size of panel. Transfer centers of holes through the paper to the Celoron panel with a pointed instrument.
The drilling can be done with a carpenter's brace or a breast drill, but metal-cutting twist drills should be used, not ordinary wood bits. Begin to drill from the front side of the panel. To avoid chipping on back, clamp panel to a board or work bench. Counter-sink holes with a larger size drill. Holes can be threaded with standard machine taps.
If a dull or mat finish is desired rub down the panel with No. 00 sandpaper. The sandpaper should be wrapped around a wooden block and the rubbing all done in one direction, not with a circular motion.
Wipe off the panel with an oiled cloth.

# As popular as radio itself

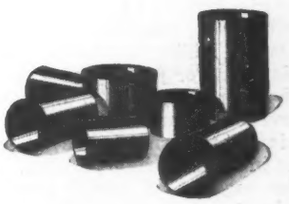
AS more and more radio novices become seasoned fans, the popularity of Celoron Panels multiplies.

Today Celoron is the accepted standard for radio panels. Sets of many foremost makes are equipped with Celoron panels and parts.

Celoron does not chip or crack. It does not soften, warp or buckle. It is infusible and will stand up under atmospheric changes.

Look for Celoron Panels where you buy your radio supplies. Insist on Celoron insulation in the parts you buy.

Celoron is also made into tubing that has all the insulating qualities of sheet Celoron. It is used extensively by manufacturers of the best radio instruments. It is made in all sizes.



*Celoron tubing holds its shape. It is made in standard lengths and diameters—all accurately cut to size.*

*This rack on a merchant's counter means that he wants to give you the best in radio parts.*

## DIAMOND STATE FIBRE COMPANY

**Bridgeport, Pa., and Chicago, Ill.**

***The oldest and largest manufacturer of vulcanized hard fibre and laminated technical materials in the world.***

***Wherever you see a factory chimney, there are countless electrical and mechanical uses for Celoron and Diamond Fibre.***

# Better Shop Methods

## How Expert Mechanics Save Time and Labor

# Secrets of Success in Grinding

## What Every Machinist Should Know about Abrasives

H. L. Wheeler

By H. L. Wheeler
*Machine-Shop Foreman*

THE art of finishing metal surfaces by grinding is a branch of metal working with which you should be familiar if you are connected in any way with machine-shop work.

While grinding has been in use almost as long as the practice of hardening of metals and tools, and probably was first used in connection with the reduction of metal that had been hardened, such as axes, tools, and machine parts requiring to be finished after hardening, the practice has grown enormously. Today machine parts of various metals, whether hard or soft, are finished by the grinding process.

The finish produced by grinding is a superior one. The grinder is in a class by itself, when compared with the lathe, milling machine, shaper, or planer. For rapid production of finished surfaces, the grinder cannot be excelled by any other machine. And so it is that the grinder is becoming a real factor in machine-shop practice.

The amount of metal removed by grinding is, of course, small. The advantage lies in the fact that very little pressure is required to remove the metal. The liability of distorting the finished piece is thus reduced to a minimum.

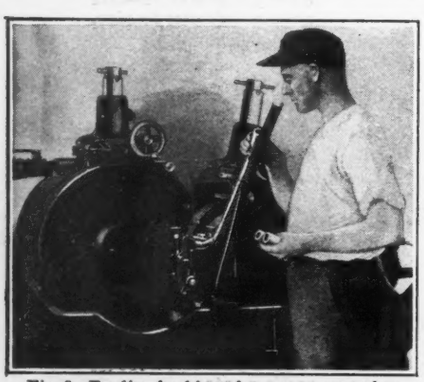


Fig. 2. Feeding bushings into a new centerless grinder. The work passes between two wheels

This is well demonstrated in finishing a very long shaft by the grinding method and finishing a similar shaft by turning in a lathe. Careful inspection of the two shafts will reveal the fact that the ground shaft is straighter and more uniform in diameter, and has a brighter and more lasting finish. A good grinding-machine operator acquires the ability to do first-class work only through several years' experience with the various kinds of grinding machines. And in many cases the man must be "acquainted" with the machine. Grinding machines develop certain peculiarities that often result in spoiled work until the operator has learned all of the little weaknesses inherent in the machine, if it be an old one, or the stiffness that is often noticeable in a new machine.

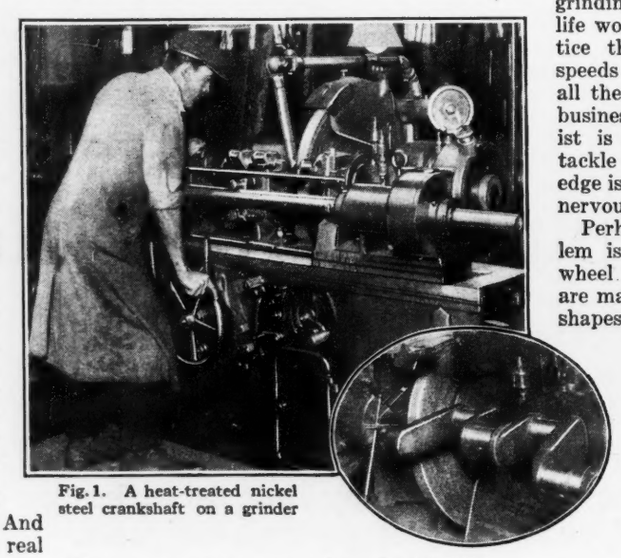


Fig. 1. A heat-treated nickel steel crankshaft on a grinder

I remember a job of grinding rolls for paper machines in a shop I was connected with a few years ago. The machine was designed for this particular job, but had been in service many years and was badly worn. There was just one man in the shop who could turn out satisfactory work on the machine. He had become so accustomed to the old grinder that he knew just how to "baby" it to turn out a good roll. As he was a man well along in years, several attempts had been made to break in new men, but they all gave it up in disgust. This was, of course, an exceptional case.

As this is the day of specialists in the machine business, there are specialists in grinding—men who make it their life work. And with constant practice they get to know all about speeds and feeds, grind-wheels, and all the ins and outs of the grinding business. But almost every machinist is called upon occasionally to tackle grinding jobs. If his knowledge is well founded, he need not feel nervous about going ahead.

Perhaps the most puzzling problem is the selection of the proper wheel for the job in hand. Wheels are made in many grades, sizes, and shapes. The grade or grit is designated by a letter or number, with reference to size of the grit of which the wheel is composed and the hardness or softness of the bond that holds the grit in place.

The particles of grit represent many thousands of cutting points. A grinding machine that is equipped with the right wheel for the work in hand and working under normal conditions will remove a given amount of metal more rapidly than any other process.

The manufacturers of grinding wheels are experimenting constantly to improve their product and are discovering new and better ways to grind. Careful records are kept of each experiment and

*(Continued on page 140)*

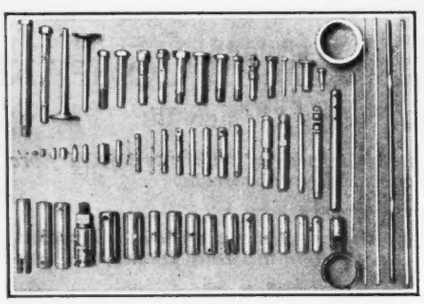


Fig. 3. Samples of the work done by the recently developed method of centerless grinding

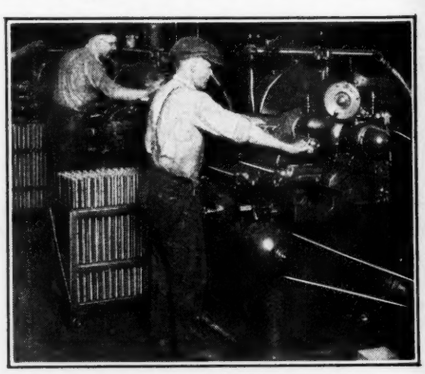


Fig. 4. A modern hydraulic traverse grinding machine used for finishing long work

**DON'T fail to turn to pages 136-146, where you will find the continuation of the Better Shop Methods Department.**

# *Why are Starrett Tools Standard in every Shop*

**Starrett**

# Fine Precision Tools—2200 from One

In something over forty years the Starrett Line has increased from a single tool, the famous Combination Square, to include over 2200 different Precision Tools, Hacksaws and Steel Tapes. Those years have seen the growth of a business that now requires the largest plant in the world devoted exclusively to the manufacture of fine mechanical tools.

From the first mechanics to whom Mr. L. S. Starrett sold his Improved Squares and Rules, the roll call of Starrett Users has grown year by year until today every country in the world which uses machinery and precision tools knows Starrett as the standard of accuracy.

What is the cause of this world-wide preference for the Precision Tools that are made in Athol, Massachusetts? If you use Starrett Tools *you know.*

*Shown in the group at the right are the following popular Starrett Tools: Micrometer Depth Gage No. 440, Improved Firm-Joint Calipers, No. 26, Fay Spring Dividers, No. 77, Quick Reading Steel Tape, No. 510 (with Leather Case and Patented Push Button Handle Opener), Micrometer No. 224 A (with interchangeable Anvils giving range of 2" to 6"), Combination Square No. 11, and Thickness Gage No. 72. Write for Catalog No. 23 "W" for description of the complete Starrett Line.*

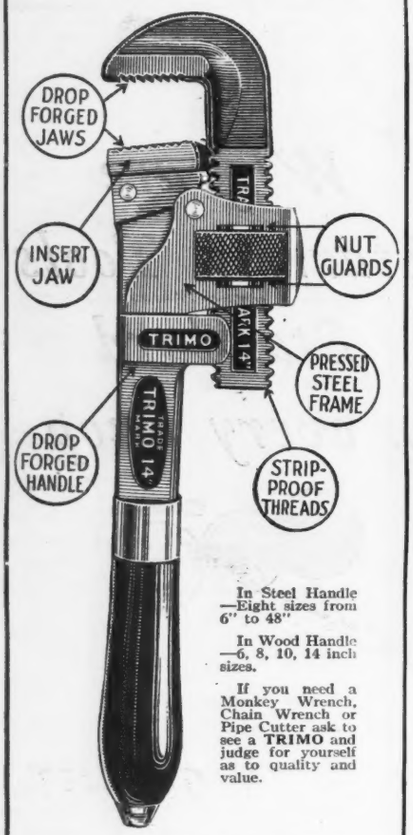
**THE L. S. STARRETT CO.**

*World's Greatest Toolmakers*
*Manufacturers of Hacksaws Unexcelled*
**ATHOL, MASS.**

7441

**This seal on a radio or tool advertisement signifies the approval of the INSTITUTE OF STANDARDS.** **See page 33.**

# Tackle That Tough Job With a Trimo




In Steel Handle—Eight sizes from 6" to 48"

In Wood Handle—6, 8, 10, 14 inch sizes.

If you need a Monkey Wrench, Chain Wrench or Pipe Cutter ask to see a **TRIMO** and judge for yourself as to quality and value.

***Endorsed by the Popular Science Institute of Standards***

Nothing is too stubborn for a TRIMO. Its sharp, deep-milled, drop-forged jaws bite hard and never lose their grip, yet do not lock or crush.

Think of the time, trouble and bruised knuckles that this all-purpose wrench will save you. Rusted bolts, battered nuts, jammed threads—all yield to TRIMO.

Nut guards to maintain adjustment, rounded threads in both movable jaw and nut and insert jaw in handle, readily replaceable when dull or worn, are important advantages that you won't find in other wrenches.

It pays to insist on TRIMO.

**Trimont Mfg. Co.**
**Roxbury, Mass.**

7464

TRIMO

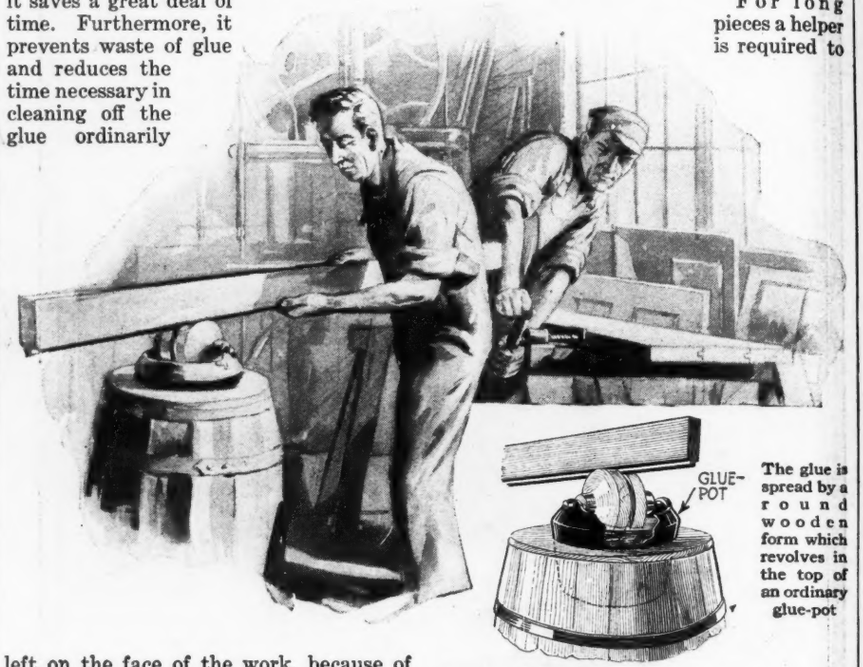

# The Home Workshop

## Novel Glue-Spreader Cheaply Built

By A. E. Elling

A MACHINE for spreading glue on the edges of boards, built as shown, will pay many times over for the slight cost and labor required in its construction.

As compared with using a glue-brush, it saves a great deal of time. Furthermore, it prevents waste of glue and reduces the time necessary in cleaning off the glue ordinarily left on the face of the work, because of the unequal brush distribution.






The glue is spread by a round wooden form which revolves in the top of an ordinary glue-pot

The glue reservoir is merely a large outer glue-pot, which is filled with hot glue from another container as often as necessary. This pot is set into the head of an empty nail keg, which is ballasted with junk iron or other weighty material.

The glue is spread by means of a wooden turning which revolves freely. This may be plain or shaped to suit a tongue-and-grooved, rabbeted or any other style of common edge joint. The bail is removed from the glue-pot and the turning is fastened loosely with screws through the holes in the bail ears. The turning should not be so large nor fit so tightly in the pot that the glue cannot drain back freely.

For long pieces a helper is required to hold up one end as the work is pushed over the spreader.

Any one accustomed only to the brush method of applying glue will be surprised at the neatness, quickness, and cleanliness of this inexpensive machine.

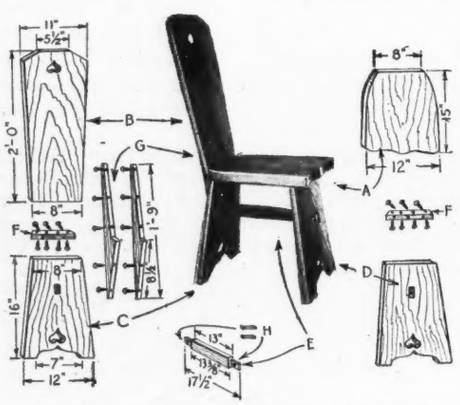
**IN RESPONSE to many requests from readers, POPULAR SCIENCE MONTHLY has in course of preparation a series of noteworthy articles on simplified model making.**

## How to Build a Dutch Crafts Hall Chair

THE Dutch crafts chair illustrated is built on simple although unique lines.

The necessary material, except the seat, may be cut from a clear, straight, well-seasoned oak or poplar board 12 in. wide, ¾ in. thick and 6 ft. long. To preserve the lines, however, the seat, *A*, should be 1¼ in. thick.

The heart-shaped openings cut in *B*, *C*, and *D* are 2 by 2¾ in. You will find it easy to draw one side of a heart, but to add the other side symmetrically is more difficult, so I suggest that you draw one side, cut it out, and use it as a templet for drawing both sides of each of the ornaments. After making the outlines, bore a small hole in each to start the blade of a coping saw or fretsaw.




This sturdy little chair calls for only a few simple parts in its construction and is easily built

Brace *E* is 1 by 1⅜ by 17½ in. Tenons are cut

(*Continued on page 127*)

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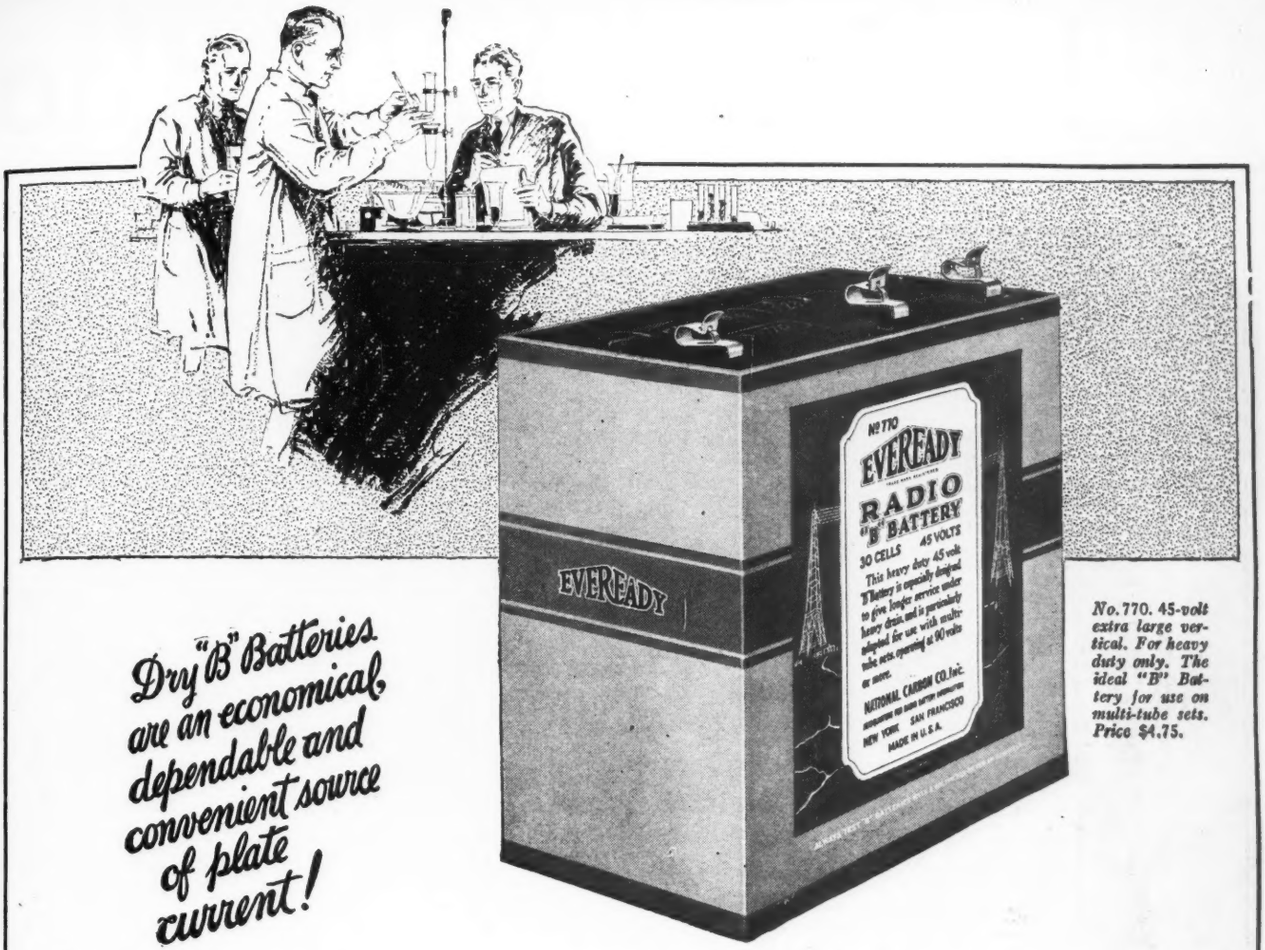

No 770
EVEREADY
RADIO
"B" BATTERY
30 CELLS 45 VOLTS
This heavy duty 45 volt "B" battery is especially designed to give longer service under heavy drain, and is particularly adapted for use with multi-tube sets, operating at 90 volts or more.
NATIONAL CARBON CO. Inc.
NEW YORK SAN FRANCISCO
MADE IN U.S.A.
EVEREADY

*Dry "B" Batteries are an economical, dependable and convenient source of plate current!*

*No. 770. 45-volt extra large vertical. For heavy duty only. The ideal "B" Battery for use on multi-tube sets. Price $4.75.*

# *Scientists constantly improve battery quality*

EVEREADY "B" Batteries today contain more electricity, more service, more satisfaction than ever before.

Processes evolved by the scientists of the Union Carbide and Carbon Research Laboratories, Inc., when put in effect in the Eveready factories, are responsible for this great accomplishment.

At the same time the factories have effected a still higher standard of workmanship. A system of inspection that is a marvel of efficiency was inaugurated. The results, gratifying beyond measure, were accomplished with a speed and completeness that have few parallels in industry.

The final tests showed more electricity, more battery service, greater Eveready satisfaction without increasing battery sizes *and with a substantial reduction in price.* "B" Battery operating costs, using the new Evereadys, in most cases show a reduction of at least one-half.

There is an Eveready Radio Battery for every radio use.

Insist on Eveready "B" Batteries.

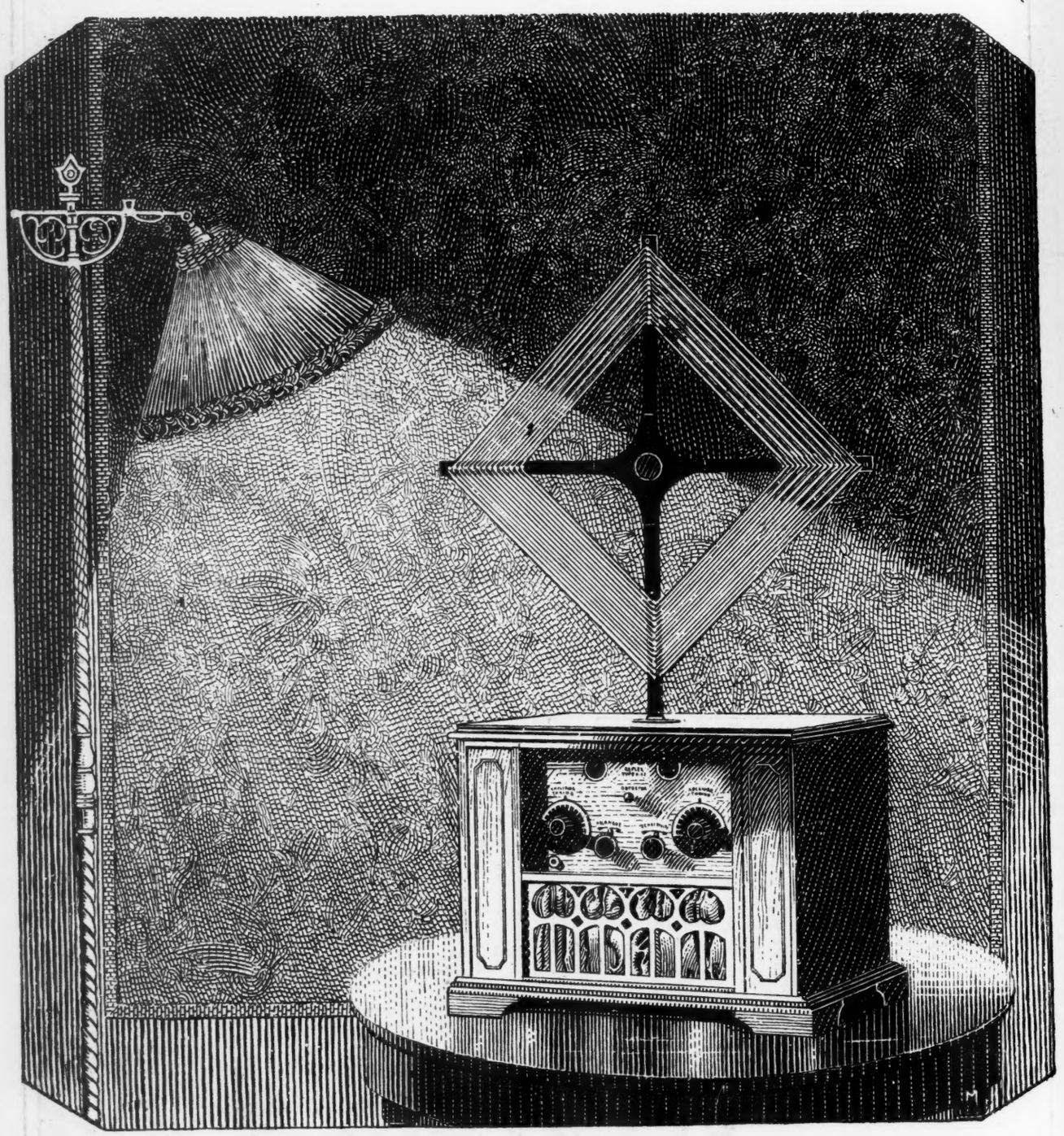
*Manufactured and guaranteed by*
NATIONAL CARBON COMPANY, INC.
*Headquarters for Radio Battery Information*
New York San Francisco
Canadian National Carbon Co., Limited, Toronto, Ontario

EVEREADY HOUR
EVERY TUESDAY at 9 P.M.
*(Eastern Standard Time)*
Broadcast through a chain of prominent interconnected radio stations.

# EVEREADY
## Radio Batteries
*—they last longer*

This seal on a radio or tool advertisement signifies the approval of the INSTITUTE OF STANDARDS. See page 33.

# You have the



## De Forest Radiophone

*Requires no aerial — no ground wire*

Batteries, De Forest Loud Speaker and Tubes complete within cabinet. Ready to operate within five minutes after delivery. Easily movable from room to room. Unsurpassed in purity of tone quality. Hear it and know.

This seal on a radio or tool advertisement signifies the approval of the INSTITUTE OF STANDARDS. See page 33.

# radio habit now!

## *You'd better have a De Forest*

WHETHER you have an instrument or not, whether you know it or not, you have the radio habit already. Do you go to the theatre? Do you go to political meetings? Do you read the day's news? Do you seek contact with people who offer either amusement or information? Then you're essentially a radio fan, for many of the best of these things radio is giving in a way that they cannot be obtained elsewhere.

Do you know what Lee De Forest means to radio? He is to it what Edison is to electricity. Naturally the De Forest Radiophone is considered standard—and its definite advantages justify its popularity.

The De Forest Radiophone is a complete and self-contained instrument with a loop the size of a picture frame instead of an aerial wire, with batteries, tubes and De Forest Loud Speaker complete in one artistic cabinet. Here is an instrument that can be easily moved from room to room. It has a remarkable tone quality. It brings out the voice or instrument as sincerely and truthfully as the performer himself does—and clears itself (with the right dial settings) from disturbing or metallic noises. Its range is unexcelled by anything in the radio-ways! And it is an immediate result-getter that is simple to operate!

Whatever there is in radio, De Forest can give it to you. It yields good results from the beginning and gradually increasing results as your skill grows.

*It will pay you to look up a De Forest Agent*

De Forest from first to last stands for all that is substantial and thorough and fundamentally right in radio. De Forest agents are qualified to give sound and practical advice and help in radio. When you find the De Forest agent in your vicinity you find a man who knows radio—a man who has given us his word that he will see that every instrument he sells is thoroughly inspected and properly serviced after the sale. Avail yourself of his help. He desires, as do we, that you should get the fullest enjoyment and satisfaction from your instrument.

DE FOREST RADIO CO.
Jersey City, N. J.

**Your Tubes are the key to your radio reception**

DV-2

If you know what the tubes do in a radio set, you'll know why nothing but De Forest Tubes will do.

Used as detectors or amplifiers, these tubes combine ideal operation with long life, sturdy strength and freedom from microphonic noises.

DV-2, for storage batteries, requires a filament potential of 4½ volts, and has a current consumption of 25/100 of an ampere.

DV-3, for dry batteries, requires 3 volts on the filament, and consumes 6/100 of an ampere.

DV-3

*The "Magic Lamp" of Radio*

# DE FOREST ®
REG. U.S. PAT. OFF.
# RADIOPHONE
REG. U.S. PAT. OFF.

(IS) This seal on a radio or tool advertisement signifies the approval of the INSTITUTE OF STANDARDS. See page 33

# SAND'S LEVELS

## Accurate and Light

THIS is the level you want for overhead work. It's so light you can use it all day without tiring. And it's handier to get hold of, too.

You can read it from any angle, even in dim light.

It's accuracy is permanently built in at the factory—you can depend on it, year in and year out.

### *Favorites Everywhere*

Sand's Levels have made good on the job for thirty years. If you like good tools you'll appreciate the many advantages of a Sand's Aluminum Level.

**24" 6 Glass Aluminum $5.50**

Others proportionately low.

Also a complete line of wood levels for every purpose.

**Look for the Name on the Genuine**

*At Good Hardware Stores Everywhere, or sent direct upon receipt of price and your dealer's name and address.*

**SAND'S LEVEL & TOOL CO.** (IS)

**5849 Fischer Ave., Detroit, Mich.**


# The Home Workshop

## How to Cut an Attractive Archway

By Edwin M. Love

IN MANY sections of the country, especially where architects of the first rank have influenced the design of small homes, it is now the custom to connect the living-room with the dining-room by means of a large plastered opening without doors or portieres.

If properly designed, such arches lend simple dignity to the rooms. They make more convenient the handling of guests at entertainments and give the effect of a single large room, while affording corners for the gathering of small, congenial groups. They also afford better opportunities for a unified scheme of interior decoration and an artistic arrangement of furniture.

Plastered archways like this are becoming increasingly popular in well-designed small homes

By reason of their adaptability to a variety of shapes and sizes of rooms, and the ease with which they can be built, arched openings can be constructed by any man reasonably familiar with the use of carpenter's tools. The procedure is largely the same, whether sliding doors, French doors, or single doors are to be removed in favor of the arch.

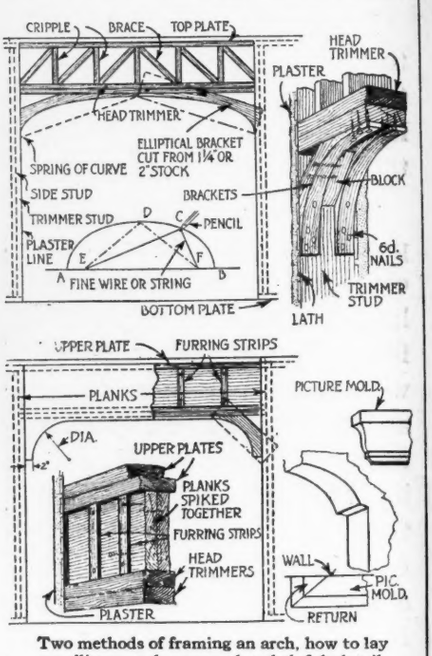
In designing the opening, attempt to center it on one or both of the rooms, although this may be impossible. Balance is the thing to consider, as well as the relation of the archway to doors, windows, and furniture.

The arches best suited to this work are illustrated. Simplicity should be the keynote, as any attempt at elaboration is almost certain to result in poor design. For most houses the ellipse is preferable. Try to make the opening noticeably narrower or wider than it is high; and take care that either the top of the arch or else the "spring"—the beginning of the curve—will be on a level with the doors and windows of the two rooms involved.

The design and location being settled upon, lay out plumb lines on the partition. Cut the plaster to the line with a cold chisel and hammer and remove to a point 2 in. below the ceiling or 1 in. below the picture molding. Then cut away the lath with a compass saw. For structural reasons it is best to make these side cuts 2 in. inside the side studs.

Remove the debris, carefully punch a hole in the plaster on the opposite side near the floor, and repeat. Next, determine if the ceiling joists bear on the partition; if they do, shore them up in both rooms by forcing smooth planks against the ceilings with two-by-fours that rest on suitable blocks on the floor.

Cut the studs off on a level 4½ in. above the finished height of the opening and remove them. Cut two trimming headers out of stock the same size as the studding, making them equal in length to the distance between the side studs. Spike them solidly together and drive up against the "cripples," or short studding above. In case these cripples are less than 1 ft. long, it is advisable to remove them also and substitute two planks of suitable width spiked together and forced up against the plate edgewise, the trimmer in turn being secured to it. Spike the ends to the side studs and double the latter by cutting extra studding to a driving fit under each header end. Nail all securely.




Two methods of framing an arch, how to lay an ellipse, and some other helpful details

The ceiling shores now may be removed. Using 1¼-in. or 2-in. pine stock, lay out the necessary curves,

(*Continued on page 126*)

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# "It's so Easy to Know the Outdoor Temperature from the Cosy Interior

## *Since I Purchased this Taylor Temprite Window Thermometer*

NO DRAUGHTS on Grandad or the baby crawling on the floor, caused by opening the doors, stepping out in the shivery weather to read the thermometer the old fashioned way, suddenly lowering the room temperature—I just glance through the window at my Temprite. I keep the cold outdoors where it belongs. It means comfort and convenience. We all dress for the weather. I dress the children accordingly for school. It's a health factor, I feel, for the whole family. And it adds a cheery touch to our home."

The illustration at right shows this superior Temprite Window Thermometer full size. The printed page cannot convey the attractive appearance. Metal, white enameled back. Weather proof. Can be read at a distance of 15 feet. Large clear numerals and markings, fadeless colored liquid in a magnifying glass tube. Comes with window brackets and nails for easy attaching to outside window frame. Adjustable to proper angle for reading the temperature from inside—and outside as well.

Possesses three essentials of thermometer character, ACCURACY, SERVICEABILITY AND ATTRACTIVENESS.

In it we have accomplished our desire to create a reliable Window Thermometer for the multitude to sell for $1.00. The Taylor Temprite is readily distinguished from the mediocre.

***Don't deny yourself the use of this distinctive thermometer another day!***

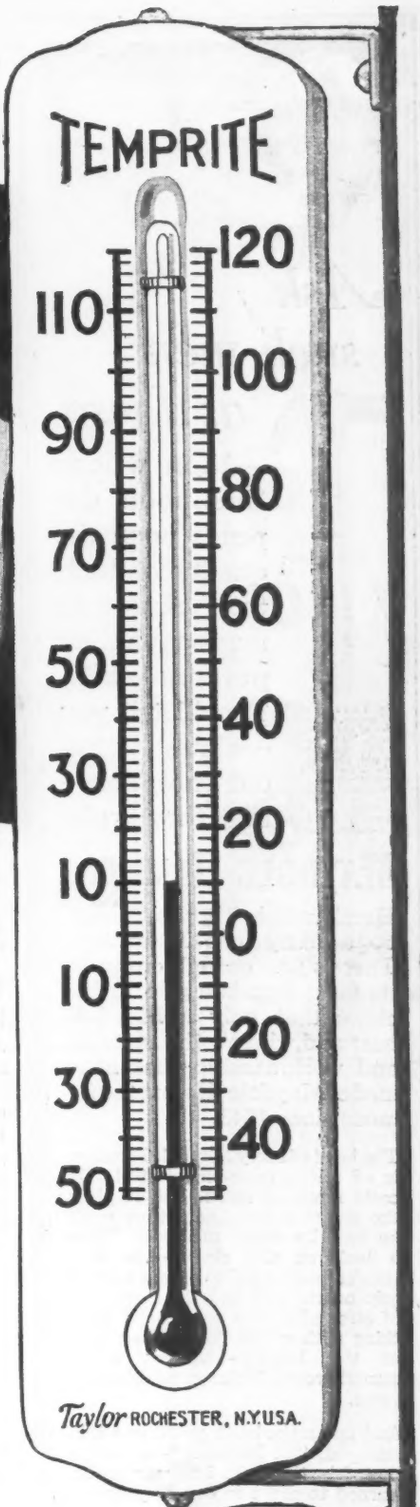
Others are enjoying the comforts and convenience it brings. *Why not you?* Easy of accomplishment—stop at your dealer's on that shopping trip, or phone the "Mister" to bring one home tonight.

You can now own this reliable Thermometer for a dollar—a small purchase that adds a touch of completeness to the home.

If not obtainable through your regular dealer, we will ship one postpaid east of the Rockies, upon receipt of $1.00. West of the Rockies, $1.10; Canada, $1.35. Safe delivery guaranteed.

*To test for readability pin this advertisement up across the room. This illustration is full size.*

Taylor TEMPRITE DOLLAR WINDOW THERMOMETER




*Canadian Plant:* Tycos BUILDING TORONTO

**Taylor Instrument Companies**
AMES ST. *at* WEST AVENUE, ROCHESTER, N.Y. U.S.A.

**Taylor Instrument Companies**
Ames St. at West Ave., Rochester, N.Y.

Please send me at once one *Taylor* Temprite Window Thermometer for which I enclose $_____ I understand you guarantee safe delivery.

Name _____
Address _____ State _____
City _____
Dealer's Name _____ PS-2

THE SIXTH SENSE OF INDUSTRY
**Tycos Temperature Instruments**
INDICATING · RECORDING · CONTROLLING

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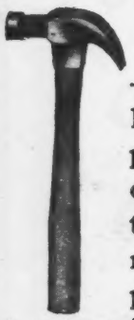
*Ask such men as these*



—Men whose livelihood depends upon the quality of their tools almost as much as on their personal skill. They'll tell you—almost without exception—that they prefer

*In 1843 David Maydole, the founder of the business said, "I make the best hammer." And throughout the history of the manufacture of Maydole Hammers the standard established by the founder has been adhered to.*

**MAYDOLE HAMMERS**

Here's why! There's "hang" to a Maydole Hammer. There's just enough crown to its face; there's a grip to the claws that only a Maydole has; and, there's the material and workmanship that have made Maydole Hammers famous since 1843.

The head of every Maydole Hammer is of finest, press-forged steel. It costs more to make, but it gives the metal a toughness that can't be had by other methods. Take a look at the claws—see how they're backed off to give a perfect grip on the nail and the maximum of strength. You can "pull" anything with a Maydole. Then look at the handle—perfect, clear, second-growth hickory, air dried for years.

And up on the head, you'll find this stamped, "D. Maydole"—a pledge that it's the best hammer we've learned to make in our 80 years.

Ask your hardware dealer—he knows Maydole Hammers. Write us for useful handbook and catalog 23-B.

**THE DAVID MAYDOLE HAMMER CO.**
NORWICH (S) NEW YORK

7543

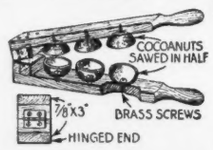
**Maydole Hammers** — YOUR HAMMER SINCE 1843


# The Home Workshop

## Snowball Press for Winter Battles

WHEN sides are lined up for a good, old-fashioned snowball battle, the team that usually wins is the one best able to hurl over the ammunition. This depends upon the supply as well as the accuracy of throwing.

The press illustrated has been designed to turn out rough-shaped snowballs in large quantities. As they are piled up, the men doing the actual throwing can press them quickly into sizable use and hurl them at the opposing side. One man with a press can keep half a dozen combatants supplied with potential snowballs for defense.



The press "roughs out" snowballs very quickly

To make a press, first choose three round cocoanuts and saw them in half. Remove the meat and set the shells aside to dry thoroughly. Meanwhile make two levers from hard wood 7/8 in. thick and 3 in. wide. Handles should be shaped at one end of each and a hardwood block screwed to the opposite end. The total thickness of the two blocks should be slightly greater than the diameter of one of the cocoanuts. Then hinge the blocks together as shown.

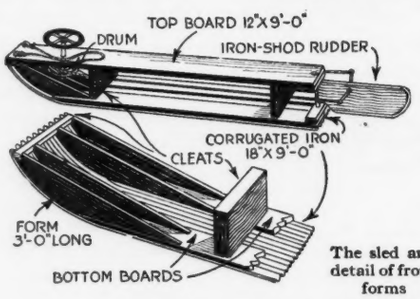
Drill a small hole in the exact center of each half cocoanut shell, being careful to keep the proper pairs of shells together. Then fasten three halves to the inside of one of the levers and the corresponding halves to the inside of the other lever so that when the levers are closed the halves will meet exactly. Use brass or galvanized screws. Oil the completed press with linseed oil.

In preparing ammunition for battle it is advisable to pile up a heap of light snow in a position where the ammunition makers will be protected. They scoop up snow in their presses, squeeze the handles together, and turn out the snowballs.

## Speedy Coaster Has Corrugated-Iron Bottom

COASTING sleds and double runners are always more or less expensive to build. The coaster I am going to describe, however, is one that can be constructed very cheaply.

The running surface is composed of a sheet of old corrugated-iron roofing nailed to a flat board surface with the seat mounted just above it on two blocks. It is steered by means of a "rudder" operated by a steering wheel mounted at the front. The wheel can be picked up for a few cents at any second-hand auto yard.




The sled and detail of front forms

This coaster is especially fast and it must be steered with caution because of the long run of the bottom. With four or five passengers, it will be found a steady and speedy conveyance and one that will furnish lots of fun for the builder.

The foundation for the iron is either one board 18 in. wide and 9 ft. long or, better and cheaper, two boards cleated together. Cut out four curved forms as indicated from good, strong wood about 10 in. wide. Cut a notch at the front end of each, as shown.

Nail the four forms to the edges of the bottom boards and connect them in the notches at the front by means of a cleat. Then turn the frame over and nail a sheet of clean-surfaced corrugated iron to the under side so the corrugations run lengthwise. Use flat-headed nails and drive them through the hollows of the iron.

When it comes to turning the iron up the sweep of the forms, bend it gently and nail frequently as you go along so that it will not crinkle or have sharp breaks in the corrugations.

Next, spike two blocks to the frame as supports for the seat board. These should be at least 12 in. high and well fastened. The seat is a plank 12 in. wide and 12 ft. long, with the corners beveled off as a finish. Nail it to the blocks so that the front end comes flush with the cleat across the ends of the forms, to which it also should be nailed.

The coaster is steered by a "rudder" made of strong wood of the shape indicated. The bottom edge should be shod with strap iron and the back edge fitted with a shaft to fit in two holes, one in the bottom board cleat and the other in the seat. An iron tiller rod is forced through the center of the rudder.

Make a wooden drum and fasten it to the shaft of an old auto steering wheel. Then run strong lines from the tiller ends and after connecting them make several turns about the drum.

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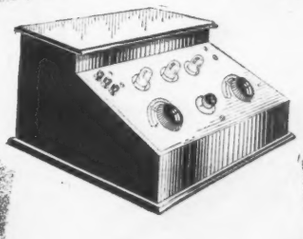
# A New Star

## The Eaglet 3 Tube Dry Cell Neutrodyne



## $75

**The World's Wonder Set at a Popular Price**

*Manufactured and Guaranteed By*

## EAGLE RADIO CO.

*Makers of*

**The Famous Models A and B EAGLE Neutrodyne Receivers**

Your protection for quality and unsurpassed

**VALUE**

Ask the dealer—he knows

EAGLE RADIO CO.
16 Boyden Place, Newark, N. J.

Ⓘ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# Power to Turn 'em

You can depend upon a sturdy Snap-On to turn the most tightly "frozen" nut.

There's a special Snap-On handle combination for fast work in every hard-to-reach place.




Snap-On engineers have made an individual selection of Snap-On handles and sockets for each individual make of car. This is the Ford Set. A diagram in the lid of the box shows the different nuts and bolts each wrench will reach and turn. Just follow the diagram and repairs on the Ford are made easy. Write for full information about the selected Kit for your car.

***Look for the name—without it no wrench is a genuine Snap-On***

Ⓢ **Snap-on**
INTERCHANGEABLE
**Socket Wrenches**

**Snap-On Wrench Co., Mfrs.**
**Milwaukee, Wisconsin**

*DISTRIBUTORS*
**MOTOR TOOL SPECIALTY CO.**
**14 E. Jackson Blvd., Chicago**

Gentlemen:
Please send me full particulars about Snap-On Kit for.....car. (If interested in Master Mechanic's Kit for all cars check here)

.....

I buy tools from.....

Name.....

Address.....

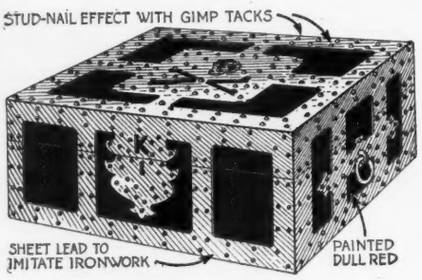

# The Home Workshop

## Easily Worked Sheet Lead Used to Ornament Treasure Chest

IN THE studio of a certain New York artist, whose work is well known to the readers of POPULAR SCIENCE MONTHLY, there was a table that always had a rather bare and forlorn appearance amid its rich and colorful surroundings.

"Do you know what I think that table needs?" the artist remarked to a friend one day. "It needs a pirate's chest, brimming over with old jewelry, coins, and stones."

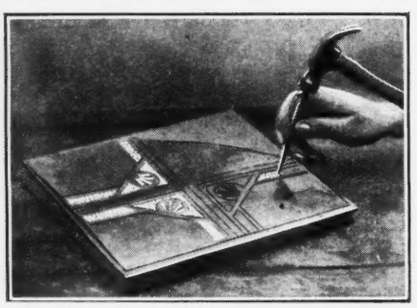
Instead of going out and buying a jewel case or an ornamental box to carry




The hand-wrought metal on this chest is sheet lead fastened with cut gimp tacks

out this idea, the artist hunted around and found an old oak sketching case of about the right size. He removed the partitions, cleaned out the inside, replaced a missing hinge, and fastened a heavy brass chain to hold the lid from flopping backward.

Next he visited a plumbing shop in the neighborhood and bought some thin sheet lead. At a hardware store he obtained a supply of gimp tacks. Returning



Hammering down the background of four box corners, made in one piece for convenience

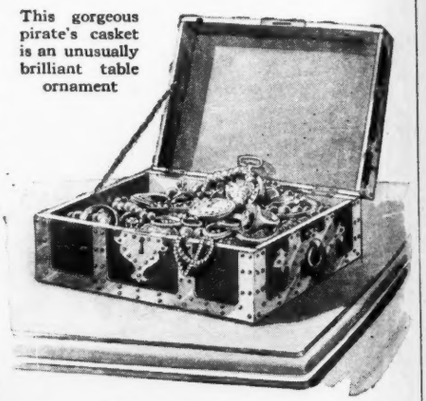
to the studio, he placed the box on the sheet lead and marked out the dimensions, as if he intended to make a metal case to cover the box.

On the lead he then sketched a design like that illustrated in the upper drawings on this page and cut out the openings with an old pocket-knife and scissors.

The sheet lead was laid over the box and hammered gently in place. Where the edges came together, the metal was peened to make an almost invisible joint. Gimp tacks were driven in to hold the lead.

The woodwork was painted a dull but glowing vermilion. Green, blue and

This gorgeous pirate's casket is an unusually brilliant table ornament



brown artists' oil colors were daubed on the lead itself in hit-and-miss fashion, and then rubbed partly off to give it an antique tone. The casket was lined with royal purple velvet and filled with old jewelry and trinkets, which were allowed to overflow onto the table.

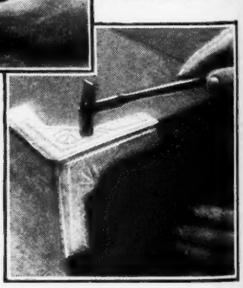
So attractive and unusual was this ornament that visitors to the studio invariably exclaimed when they first saw it. Yet the work and cost amounted to very little, and the chest could be duplicated easily by a handy man.

Another method of decorating boxes and chests is to apply corners made as shown in the lower illustrations on this page. The design is worked out on paper full size and traced by means of carbon paper on thin aluminum, brass or copper.

One of the simplest ways of bringing out the design is to recess the background by hammering depressions of uniform depth into it with a punch. The metal should be firmly fastened to a waste piece of board while the hammering is being done.

The final step is to cut out the design and fasten the corner strips in place with brass or copper nails or escutcheon

After the design is worked out with hammer and punch, the corners are cut with old scissors (at left)



Fastening a chest corner of thin sheet aluminum in place with upholsterer's small nails (at right). Sheet brass or copper may be applied in the same way

pins. The corners then may be connected with longer strips, which bind the edges of the box. These may be combined with various types of central ornaments and bandings cut from the same metal.

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LET the others have their card games—Grandpa settles down to real amusement—at the radio.

His dependable Brandes Headset shuts out the babble. Its *Matched Tone* gives him each word clearly—with identical tone and equal volume for both ears.

Grandpa's in a world of his own—and the game continues undisturbed. Everybody's happy!

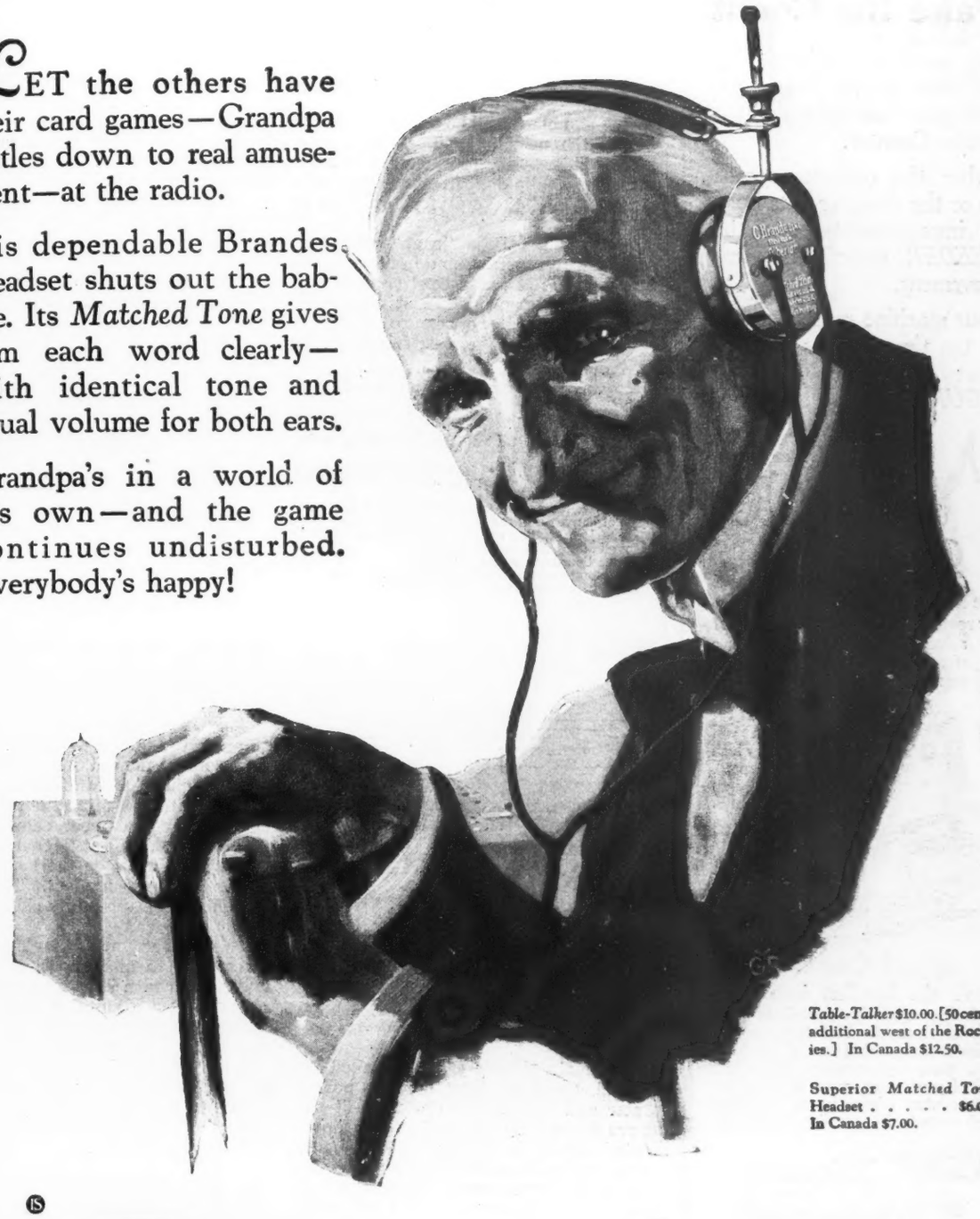

*Table-Talker* $10.00. [50 cents additional west of the Rockies.] In Canada $12.50.

Superior *Matched Tone* Headset . . . . . $6.00. In Canada $7.00.

# Brandes

## *The name to know in Radio*

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## Slow Machines Take the Count

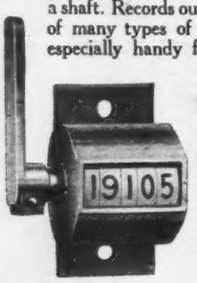
Any machine that's running too slow or producing too slow gets "*counted out*" by a Veeder Counter.

Either the operator speeds up or the designer gets busy on improvements—and the *VEEDER* records the improvement.

Your machine must run well all the time, for its product must run into *profitable FIGURES* on a

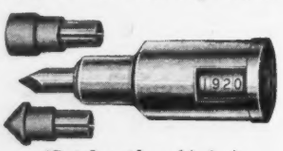
Veeder COUNTER

The small Revolution Counter below registers one for a revolution of a shaft. Records output or operations of many types of light machinery; especially handy for counting the turns of radio coil winders. Mechanism will stand a very high rate of speed. If run backward the counter subtracts. Price $2.00. (*Cut 4-5 size.*) Small Rotary Rachet Counter to register reciprocating movements of small machines, also $2.00.




### Speed Counter

Here's the handiest instrument for finding revolutions-per-minute of a shaft or flywheel. You hold the tip of the counter against end of revolving shaft; press lightly when the second hand of your watch comes to 0; release pressure when minute is up. A spring clutch controls the recording mechanism.




(Cut less than ½ size)

The Veeder Speed Counter enables you to keep motors, engines, generators, line shafting and machines operating at **efficient speeds.** Price, with two rubber tips, (as illustrated) $3.50.

***FREE—The 80-page Veeder booklet of counters you'd like to see—and set working.***

**The Veeder Mfg. Co.,**
**44 Sargeant St. Hartford, Conn.**


# The Home Workshop

## Making a Wash-Boiler Sport Sled

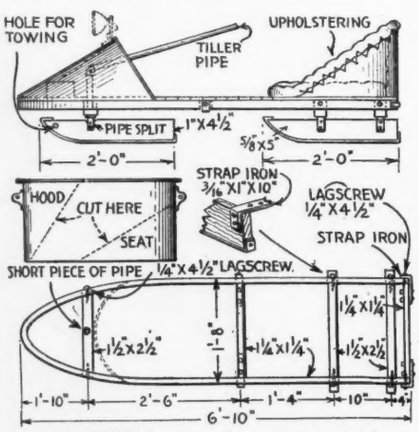
By Dale R. Van Horn

THIS sled, painted in red or yellow and black, will be the envy of every boy in the neighborhood. It requires a little skill in fitting the pieces, but there is nothing really difficult about the construction, and the cost for materials is small.

There is a certain "snap" and class about this racer not found in most home-made sleds. It has a cowl or dash and a comfortable padded seat patterned after the seat of a sport car.

Here is a list of the materials required:

One old wash-boiler, preferably copper.
A hickory, ash, or elm stick 14 ft. long and 1¼ in. square.
Three cross pieces, 1½ by 2½ in., elm or fir, 24 in. long.
Two cross pieces 1¼ by 1¼ in., elm or fir, 18 in. long.
One pipe collar 1 in. in diameter and 2½ in. long.
A length of ¾-in. pipe and a quarter-turn coupling.
Two washers, some strap iron for the braces, a piece of canvas and rags for the upholstering.
Some ½-in. ceiling or wainscoting (tongued-and-grooved strips of wood) for the floor.
Three boards to make the runners.
Some bolts and lagscrews of the sizes shown.
Paint or varnish stain of the desired color.




Working details of racing coaster, which has an upholstered seat and streamlined hood

The main outside strip is soaked for several hours or treated with boiling water and bent in the center to fit the curve formed by the end of the hood. This is found by cutting the wash-boiler as shown by the dotted lines to make the hood and the seat back. The rear ends of the strip are fastened by the last cross piece, which is notched to suit and held with lagscrews and strap-iron corners bolted in place.

THE middle cross piece is attached similarly, while the one in front is cut to fit snugly inside the curved sides. The upper edges of these three strips lie flush with the top of the outside frame.

The front runner is pivoted to the split pipe so that it will move freely up and down. This pipe extends through the 1-in. pipe collar, which is set through the center of the front cross piece. Two washers, placed between the split and spread end and the collar, reduce friction. Above deck, the ¾-in. pipe is threaded (short enough to work easily when the dash or hood is in place) and a quarter-turn coupling turned on. A straight piece of pipe then is screwed in to form the tiller. After this is done, a hole should be drilled through the lower end of the coupling and the top of the vertical pipe and a small bolt put through.

The top of the frame is covered with ½-in. wainscoting. The hood is attached

by tacking the cut edge to the sides of the frame. The original rim or flange on the boiler gives this piece a finished appearance.

The seat section is tacked down through the bottom. Small holes are drilled about the rim, 2 in. down and 2 in. apart. The sides and seat proper are padded with old rags and the canvas is cut to fit. The upper edge is laced in place. Drive nails at 2- or 3-in. intervals in both directions on the bottom to produce a real cushion effect. The nails can be clinched on the under side to prevent their pulling out.

The runners now should be put in place. Cut them as shown and cover the lower edges with light strap iron, held in place by countersunk screws. A hole is bored through the front runner for towing purposes. The two rear runners, which also are capped with strap iron, are parallel and attached by strap-iron braces bolted to the two special cross pieces as indicated. Finish the runners with a file until they are bright.

A SPOTLIGHT can be clamped to the top of the hood, if desired, with a small storage-battery set underneath the cowl.

No brake has been provided, but if one is desired, a simple strap iron, bent to the shape of a hockey stick with the end flattened and bolted to the left side, will give sufficient leverage.

If placing the feet under the hood is not comfortable, set another cleat under the frame and with the ends extending 5 in. on each side, the exact location to be determined by trial.

The canvas should be given a coat of shellac or non-injurious paint. Place a bicycle handle-bar grip on the end of the tiller, if you have an old one.

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# Music Master Gives Life to Radio Voices

WORLD fame comes to singers through a mysterious something in the voice—a personal quality that grips the hearers and holds them in a spell of delight.

When voices with delicate modulations and elusive sweetness of tone are broadcast, only a master instrument can reproduce them faithfully. Such an instrument is Music Master.

Two celebrated opera stars sing the Duet of the Flowers from Madame Butterfly. Hear the quality of greatness in their voices, as it can be heard only through Music Master.

Radio impulses entering the sensitive precision instrument in the base are translated into sound waves, undistorted and faithful to the original voice or instrument. In the tapered tone chamber of cast aluminum these sound waves grow clear and bell-like and, finally, the full, mature tones pour forth in rich resonance through the Music Master amplifying bell of natural wood.

Music Master is a musical instrument—*the musical instrument of radio.* Hear it at your dealer's; or, better still, have one sent to your home to prove with your own set.

*Dealers Everywhere*

**Music Master Corporation**

*Makers and Distributors of High-Grade Radio Apparatus*

10th and Cherry Streets

Chicago PHILADELPHIA *Pittsburgh*

# Music Master
## RADIO REPRODUCER

*Connect* MUSIC MASTER *in place of headphones.*

*No batteries required.*

*No adjustments.*

| | |
|---|---|
| MODEL VI 14 inch bell | $30 |
| MODEL VII 21 inch bell | $35 |
| MODEL VIII (*Cabinet Type*) with "Full Floating" Wood Horn | $35 |

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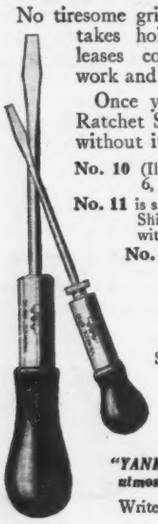
Ratchet Shifter—Right, Left or Rigid Adjustment
It doesn't take long to put on door hinges, or to do any work where screws must be driven, if you use a "Yankee" Ratchet Screw-driver.

# Fast work with a "YANKEE" Ratchet Screw-driver

And easier work, too. One grip on the handle is all that is needed, then turn to and fro, and the "Yankee" Ratchet does the rest.

No tiresome grip-and-let-go. The Ratchet takes hold going forward, and releases coming back. It does the work and saves your muscles.

Once you have used a "Yankee" Ratchet Screw-driver you'll never be without it.



**No. 10** (Illustrated) comes with 2, 3, 4, 5, 6, 8, 10 and 12 inch blades.

**No. 11** is same as No. 10 except that Ratchet Shifter moves across instead of parallel with blade.

**No. 15** has knurled thumb turn, comes with 2, 3, 4, 5, 6 and 8 inch blades. The knurled thumb turn lets you start little screws with thumb and forefinger.

**Some other "YANKEE" Tools**

Spiral Screw-drivers
Automatic Push Drills
Ratchet Hand Drills
Ratchet Bench Drills

**Dealers everywhere sell "YANKEE" Tools**

***"YANKEE" on the tool you buy means the utmost in quality, efficiency and durability***

Write for FREE "Yankee" Tool Book

NORTH BROS. MFG. CO., Philadelphia, U.S.A.

# "YANKEE" TOOLS

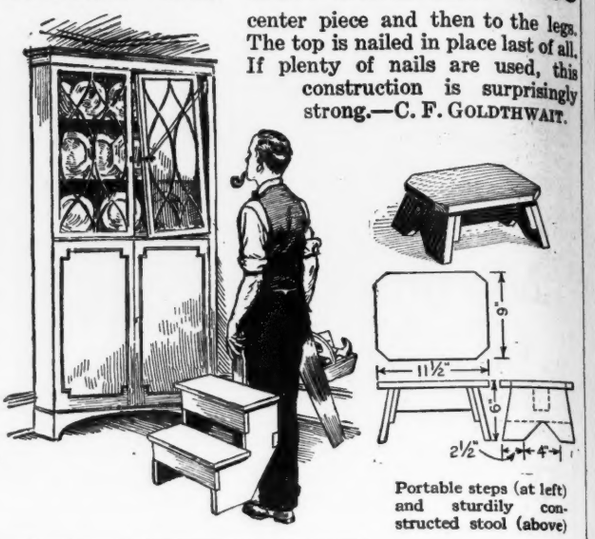
*Make Better Mechanics*


# The Home Workshop

## Steps and Stools for Household Use

FOR use around the home, office, or factory, portable steps made as illustrated are often useful. The handle saves stooping and makes it easy to carry the steps in one hand.

A small stool also has many uses. The legs of the one shown at the right are sawn out at one time from two boards tacked together. All the angles, except those at 45 deg., are laid out with one setting of a bevel square. The inner end pieces are cut with the grain at right angles to that of the legs and they are nailed to the center piece and then to the legs. The top is nailed in place last of all. If plenty of nails are used, this construction is surprisingly strong.—C. F. GOLDTHWAIT.




Portable steps (at left) and sturdily constructed stool (above)

## Toy Ice-Boat Sails as Fast as the Wind

SAILING a model ice-boat is a fascinating diversion from the more ordinary winter sports of skating and hockey.

To build a toy of this kind, construct a frame of two pieces of wood, one ⅜ in. by 1½ by 10 in., and the other ¾ by 1½ by 24 in., lapped and nailed together to form a cross. Drill a ¼-in. hole 9/16 in. deep into the frame to take the mast. With two flat-head screws attach a wooden block 1 by 2½ by 7 in. to the frame at the rear and drill a ¼-in. hole for the rudder post.

Miniature ice-yacht

A ¼-in. dowel stick, 16 in. long, serves as a mast. Two grooves are made in it as guides for the screweyes in the ends of the gaff and the boom. Three holes then are drilled near the top of the mast about ⅜ in. apart from each other. These are for fishline "ropes" and wire guys. The mast is fitted into place with carpenter's glue.

The runners are 1 by 2 by 7 in. wooden blocks. On each fasten a 1/16-in. thick angle iron with a round-head wood screw. The angles should be attached to the runners with the base of the angles on the inside of the runners' center lines. The runners then are fastened with No. 6-32 round-head machine screws and nuts to 1/16-in. angle irons attached as shown to the crosspiece of the frame.

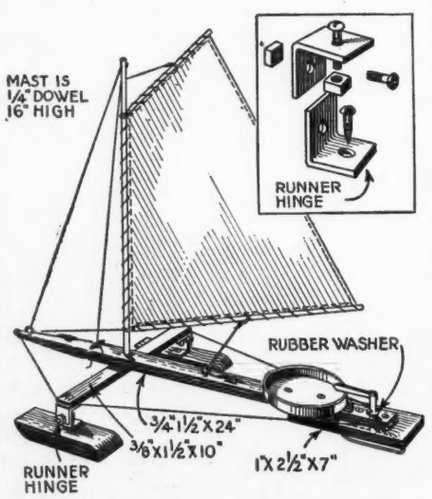
The rudder is a piece of sheet iron 1/16 by 1 by 5 in., with a brass shaft ¼ in. in diameter riveted to it. The handle is fastened to the rudder shaft after assembling to the frame. The rudder is kept in a fixed position for steering purposes by the pressure of a pin in the rudder shaft against a rubber washer.

A tin cover about 4 in. in diameter is fastened to the frame to add to the realistic appearance of the toy.

To brace the mast, wire shrouds may be run from the mast top to the outriggers on each side, although these are not shown on the drawing.

The sail is made from linen, hemmed at the edges. A brass ring 5/16 in. in diameter is slipped on the gaff and another on the boom at the point indicated. A fishing line is tied to each ring and fastened to cleats. The fishing line that holds the sail in place is sewed through the sail at intervals of ¾ in. and the ends are held in slots in the ends of gaff and boom.

Give the boat a coat of paint and a "snappy" name.—FRANK HARAZIM, N. Y.




The completed toy ice-boat and detail of the angle-iron connection for each runner

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# Electricity Needs You

## I Will Train You At Home

Stop right here. This is YOUR BIG OPPORTUNITY. Electricity is calling you. The Electrical Industry is the fastest growing thing in the world. It is expanding at the rate of a billion dollars a year. But it needs more trained men—big pay men. With my Home Study Course in Practical Electricity I can quickly fit you to fill one of these big-pay jobs.

### "Cooke" Trained Men Get the Big Jobs in Electricity

They get the big jobs because they are trained to fill big jobs, by a practical man who has been through the hard mill of experience himself. Here are some of the things that my "Boys" get when they enroll for my course—The lowest priced, and very best home-study Course in Electricity ever offered by any one. Any course that does not give you all these things is not a complete course.

1. Practical instructions by a practical engineer—a college trained man backed up with many years of practical experience.
2. Simplified instruction—Lessons so easy to master that lack of education or experience is no drawback.
3. Free employment service, supervised by an expert employment man, that actually gets you the job you want.
4. Special instruction that helps you *earn extra money* in your spare time right from the start.
5. Free complete outfit of tools and electrical apparatus—not toys but real honest-to-goodness equipment that you can use in your work.
6. Free Unlimited Consultation Service that helps you with unusual problems while you are studying and afterward.
7. Free Subscription to monthly Engineering Magazine which keeps you posted on all new developments in electricity.
8. Free use of Electrical Laboratory where you can come for actual experience or to develop an idea of your own.
9. Free Accommodations for visiting students while working in laboratory.
10. Free special courses on Radio, Auto Electricity, Electrical Drafting and a splendid Business Course for men who want to go into business for themselves.
11. Guarantee of absolute satisfaction or your money refunded.

Be a "Cooke" Trained man and get into the Big Pay class yourself. Earn $3,500 to $10,000 a year.

## Earn $70 to $200 a Week

You've always had a liking for Electricity and a hankering to do electrical jobs. Now is the time to develop that talent; and make big money out of it. Even if you don't know anything at all about Electricity you can quickly learn it through my simplified and practical method of teaching. I have trained thousands of men and put them in big-pay jobs, in all parts of the country. I can place thousands more in similar positions. As Chief Engineer of the great Chicago Engineering Works, a million dollar institution, I know where the big jobs are and what you must know to fill them—that's what I give you in my Course. Get ready now—let me train you to earn $3,500 to $10,000 a year.

## Be a Big Paid Electrical Expert

What are you doing to prepare yourself for a real success? At the rate you are going where will you be in ten years from now? Have you the specialized training that will put you on the road to success? Have you ambition enough to prepare for success, and get it?

You have got the ambition and I will give you the training, so get busy. I am offering you success and all that goes with it. Will you take it? I'll make you an ELECTRICAL EXPERT. I will train you as you should be trained. I will give you the benefit of my advice and 20 years of engineering experience and help you in every way to the biggest possible success.

## Valuable Book Free

My book, The "Vital Facts" about Electricity, has started many a man on the way to fortune. It shows how you, too, can quickly become a highly paid Electrical Expert. I will send a copy; free and prepaid, to every person answering this advertisement.

**Act Now!** Good intentions never get you anywhere. It is action, alone, that counts. NOW IS THE TIME TO ACT. *Mail the coupon NOW.*

**L. L. Cooke, Chief Engineer**

**CHICAGO ENGINEERING WORKS**

**2150 Lawrence Ave., Chicago, U. S. A.**

**Dept. 532**

**CHIEF ENGINEER COOKE**
**Chicago Engineering Works**
**Dept. 532, 2150 Lawrence Ave.**
**CHICAGO, ILL.**

Dear Sir:

You may send me, entirely free, and fully prepaid, a copy of your book, The "Vital Facts" about Electricity, and particulars about your Home Study Course in Electricity and your special *free* features.

Name.....

Address.....

City.....State.....

**The Cooke trained man is the "Big-Pay" man**

This seal on a radio or tool advertisement signifies the approval of the INSTITUTE OF STANDARDS. See page 33.

Red Devil Tools Better Made

"Red Devil" Pliers —Your First Choice

No. 1226

There are many different styles of pliers, and many different makes. You want to be sure you get the styles best adapted to your purpose, that you get properly made pliers, that they will do exactly what you want them to do, and will last for years.

Look at the workmanship—see that the handles fit the hand snugly, and do not pinch—try the wire cutters, and see if they are properly set.

The "Red Devil" trade mark is your assurance that every one of these points has been properly looked after, in the design and manufacture.

"Red Devil" Extra Heavy Slip Joint Plier No. 1226, 7 inch size, $1.25 each.

"Red Devil" Adjustable Wrench

No. 90

A most convenient tool for all-around usefulness. Gives better leverage than the old style monkey wrench. Sturdy forged steel jaws will not spread. No. 90—sizes 4, 6, 8, 10 and 12 inches. 8 inch size, 80c each.

"Red Devil" Tools are on sale at all hardware dealers—if not in stock send dealer's name and order from us.

*Mechanic's Tool Booklet FREE*

**Smith & Hemenway Co., Inc.**
*Mfrs. of "Red Devil" Tools*
**264 Broadway, New York, N. Y.**

*"Red Devil" Rapid Boring Auger Bits are 33⅓% easier boring, have 10% greater clearance, and bore with or against the grain of any wood. Style 2400—10/16 in. shown here. 80c.*

# The Home Workshop

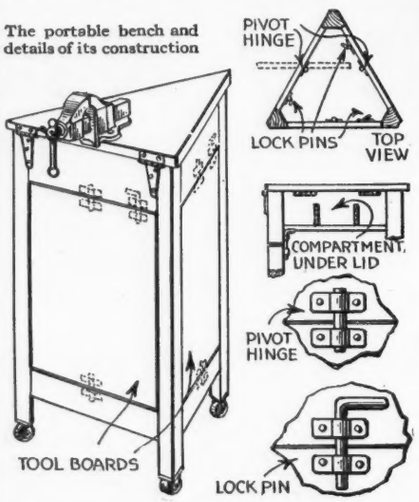
## Tool Cabinet Combined with Bench

"THE bench in my garage isn't of much use," Frank Robey, a neighbor of mine, remarked one day. "It always seems to be on the wrong side or end of the car. It gets in my way when I am washing the car with the hose, and whenever I work outside, under the oak tree, the bench might as well not exist at all."

"Why don't you make yourself a portable bench?" I suggested.

As a result, Robey designed and built the tool-cabinet bench illustrated. It is

The portable bench and details of its construction




portable; it has a small but serviceable working space on top that can be reached from every side, and the tools, while instantly accessible, can be locked up.

One advantage of the bench's triangular shape is that the casters find an even resting place on the floor or ground anywhere.

The tool boards, which form the sides of the cabinet, are pivoted at their centers so that they can be turned completely around to expose the tool equipment. The top is hinged to allow access to a compartment underneath for small tools and parts. Under the lid are three small lockpins, which hold the tool boards shut. When these pins are in place and the top is locked, the cabinet cannot be opened.

A small bench vise is placed at the hinged edge of the top so that it does not have to be lifted any considerable distance when the top is raised.—G. A. L.

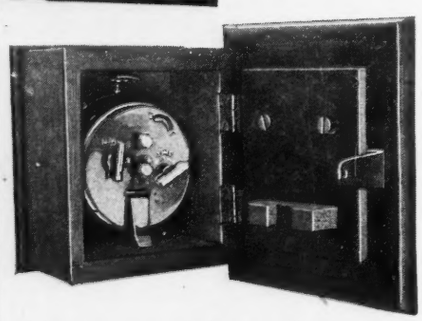
**"HOW to Construct a Machinist's Tool Chest" and "A Nail and Hardware Cabinet" are two articles on shop equipment scheduled for early publication in the Home Workshop.**

## Neat Case Camouflages Alarm Clock

OCCASION recently arose in a technical laboratory to install an alarm clock. Although the best grade of alarm clock was purchased for the purpose, its nickel finish did not harmonize well with the elaborate mahogany fittings of the balance of the apparatus.

The clock was an eyesore until the chemist in charge designed a mahogany case to hold it. The back is fastened to the wall by two wood screws. The front is hinged to the back and carries a spring catch. When the case is closed, the clock is held firmly in place by the pressure of two small felt-covered blocks.

Both the alarm feature and the excellent timekeeping qualities of the clock, together with its moderate cost, are combined in an article that at a short distance would be taken for a high priced chronometer in its case.—CAPT. S. P. MEEK, U. S. A., Philadelphia, Pa.



This homemade mahogany case is designed so that the clock may be wound and set easily

### Ornamental Desk Eraser

AN ORNAMENTAL eraser holder can be made from your favorite pocket knife after its ordinary usefulness is over. Remove the rivets, lift out the old or broken blade ends, the springs and the compartment dividers, and fasten a round typewriter eraser at each end.—J. E. N.

This seal on a radio or tool advertisement signifies the approval of the INSTITUTE OF STANDARDS. See page 33.

*Write today for your FREE copy of—*

# Ward's New Radio Catalogue

THIS advertisement is published to tell you three things everyone interested in Radio *should know*.

That we believe Ward's is today the greatest Radio store in the world —that it is the real Headquarters for Radio.

Second, that at Ward's you can buy everything in Radio without paying the usual "Radio Profits."

Third, that this big 68 page book —a genuine reference book on Radio —is yours free for the asking.

## *Our Radio Experts*

This Catalogue is a book gotten up by experts. It shows all the best hook-ups, everything in parts and complete sets—so simple that you yourself can easily install them.

And it shows only tested and approved Radio equipment—selected by our Experts who are up-to-the-minute in Radio.

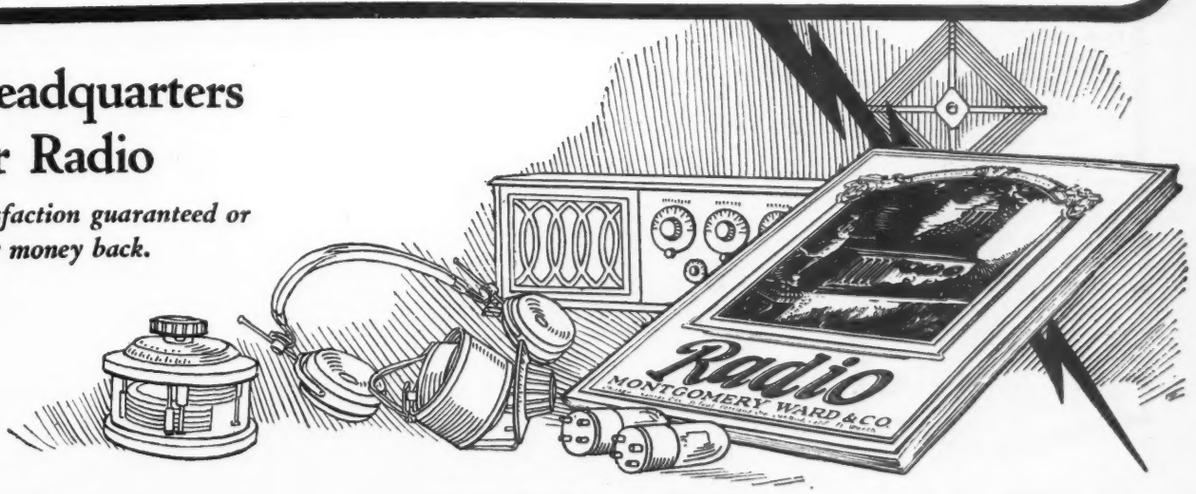
You can just as well have the benefit of our expert knowledge of Radio. Write for Ward's free 68 page Radio Catalogue and see the low prices.

## *Our 52 Year Old Policy*

In buying Radio from Ward's you are buying from a house whose reliability is above question. For 52 years we have sold quality goods only. Address our house nearest you. Dept. No. 5-R.

## Headquarters for Radio

***Satisfaction guaranteed or your money back.***




ESTABLISHED 1872

# Montgomery Ward & Co.

***The Oldest Mail Order House is Today the Most Progressive***

Chicago Kansas City St. Paul Portland, Ore. Oakland, Calif. Fort Worth

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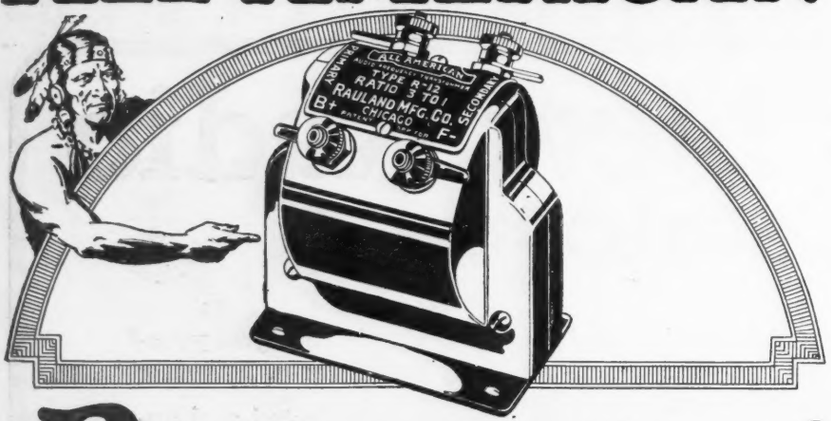
# ALL-AMERICAN




# Reliable!

## Other ALL-AMERICAN Guaranteed Radio Products

**Power Amplifying Transformers (Push-Pull)**
Input type R-30 ..... $6.00
Output type R-31 ..... 6.00

**Rauland-Lyric**
A laboratory grade audio transformer for music lovers. R-500 ..... $9.00

**Universal Coupler**
Antenna coupler or tuned r. f. transformer. R-140 ..... $4.00

**Self-Tuned R. F. Transformer**
Wound to suit the tube. R-199 $5.00. R-201A $5.00

**Long Wave Transformer (Intermediate Frequency)**
(15-75 kc.) R-110 ..... $6.00

**10,000 Meter (30kc.) Transformer**
Tuned type (filter or input). R-120 .. $6.00

**Radio Frequency Coupler (Oscillator Coupler).** R-130 $5.00

**Super-Fine Parts**
Consisting of three R-110's, one R-120 and one R-130 $26.00

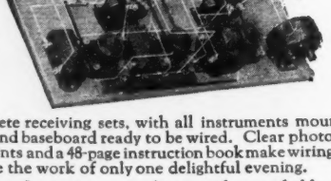
***The Radio Key Book***
The most valuable book of radio facts ever published, contains practical helps and tested hook-ups. Sent for 10 cents, coin or stamps.

ALL-AMERICAN Standard Audio Frequency Transformers in any radio receiving set mean but one thing—*assured* efficiency in amplification. Since 1919 ALL-AMERICAN Audios have answered the demand for an instrument that could be *relied* upon for maximum amplification and faithful tone reproduction. Set builders who know radio do not experiment—they specify ALL-AMERICANS.

## Precision-Made

ALL-AMERICAN reliability is a natural result of ALL-AMERICAN *precision manufacture.* Special machinery and testing equipment assist in achieving perfection. When you are buying a new set, look under the lid for ALL-AMERICANS—or install them in your present set if they are not already there. You'll appreciate the difference in amplification. 3 to 1 Ratio, $4.50. 5 to 1 Ratio, $4.75. 10 to 1 Ratio, $4.75.

## All-American Reflex



Complete receiving sets, with all instruments mounted on panel and baseboard ready to be wired. Clear photographs, blueprints and a 48-page instruction book make wiring so easy as to be the work of only one delightful evening.

All-Amax Junior is a one-tube set with remarkable selectivity and volume. It tunes out the locals and gets real distance, or it brings in the local stations on the loud speaker.

All-Amax Senior is a three-tube set with three stages of r. f. amplification, crystal detector and two stages of audio. It is highly selective and brings in the far-distant stations on the loud speaker.

All-Amax Junior (semi-finished) . . . . . $22.00
All-Amax Senior (semi-finished) . . . . . 42.00

**RAULAND MANUFACTURING CO.**
**PIONEERS IN THE INDUSTRY**
**2668 Coyne Street** **Chicago, U. S. A.**

*The Largest Selling Transformers in the World*


## The Home Workshop

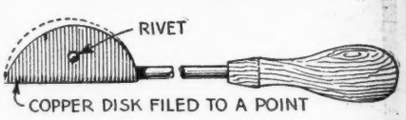
### Tricky Quebec Ski Coaster

THIS tricky coaster seems to be a purely French-Canadian invention, seldom seen outside Quebec Province.

It is made of the front half of a ski, usually found among winter equipment in the cellar. Its length will depend upon the size of the user—4 ft. as a rule.

The upright is a bit of soft wood about 3 by 4 by 16 in. screwed on through the bottom of the ski about 1 ft. from the back. A piece of smooth board about 14 in. long then is screwed crossways on the top of the upright. A coat of varnish greatly improves the appearance.—EDMUND L. NESBITT, Quebec, Can.

### Small Soldering Copper Useful in Radio Construction

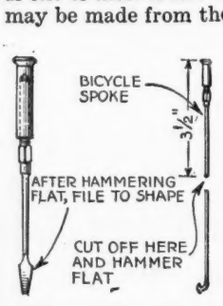



FOR radio work and other small soldering jobs many makeshift soldering coppers are used. Most of them are open to the objection that the tinning burns off too easily.

I find this difficulty is overcome by making a copper, as shown above, from a disk about the same diameter as a Canadian penny. The disk is folded along its center over the piece of wire and fastened with a small rivet. The other end of the wire is inserted in a suitable handle. The copper then is pointed, smoothed with a file, and tinned.—W. E.

### Bicycle Spoke Forms Substitute for Jeweler's Screwdriver

FOR tightening the bows of spectacles or the screws that hold a watch movement in the case, or other small screws, it is necessary to use a jeweler's screwdriver. If one of these is not at hand, a substitute may be made from the spoke of a bicycle wheel.




A screwdriver for minute work

Cut it off as shown, hammer the wire end flat, bevel it back about ⅜ in., then file to the desired shape and size. No heat is necessary, as bicycle spokes are a good grade of steel. — ROY C. BRADBURY, Elizabeth, La.

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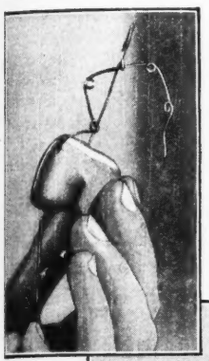
## The Home Workshop

### Comical Boxing Dolls Made of Putty, Lead, and Wire

By Kenneth B. Murray

BOXING dolls that are comical in action and certain to cause hilarity in any company of children or grown-ups, can be made quite easily.

A white and a colored boxer, possibly representing Dempsey and Wills, make a lively and mirth-provoking pair. Because they are made with spring-steel wire, their arms swing back and forth in a menacing manner for half a minute at a time whenever the two fighters are pushed together.



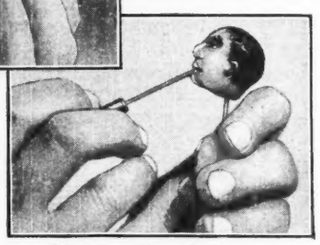
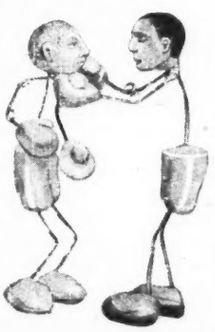


Fig. 1 (above): Inserting springs into the putty

Fig. 2. The features are modeled with a knitting-needle

To make the dolls, you will need putty, lead, spring wire, eyebrow pencil, and lipstick. The putty is molded into the shape of the trunks, gloves and heads. The wire should be cut to suitable lengths, bent, and inserted into the putty while the latter is soft (Fig. 1).



To shape the features, use a pointed instrument such as a knitting-needle (Fig. 2). The lipstick and eyebrow pencil are used to give color to the lips, cheeks, hair and eyebrows.

Fig. 3. A pair of boxers and four heads colored with lipstick and eyebrow pencil

The feet, to keep the figures upright, are made of lead. A chunk of this soft metal can be pounded and squeezed to a suitable shape with hammer and pliers.

Figure 3 shows the completed figures and several types of heads.


# The Drill with the *unbreakable* Ratchet

HUSKY, handy, compact, easy-working, trouble-proof—that's this Goodell-Pratt ratchet hand and breast drill.

The big feature is the perfected, never-fail ratchet mechanism. The strength of the ratchet is due chiefly to the fact that the teeth are broached on the inside of the drop-forged crank hub, then case-hardened. The dogs are of hardened steel and so located that the force is almost entirely compressive—there is almost no shearing action. Ratchet is both right and left hand—operated by turning the knurled ratchet dial.

This drill has two speeds, controlled by turning the shifter knob. Steel spindle runs in ball bearings. Polished hardwood handle, and side handle.

The all-steel chuck has three hardened jaws for holding round shank drills 0 to 3/8 inch.

*Other tools for the home workshop*

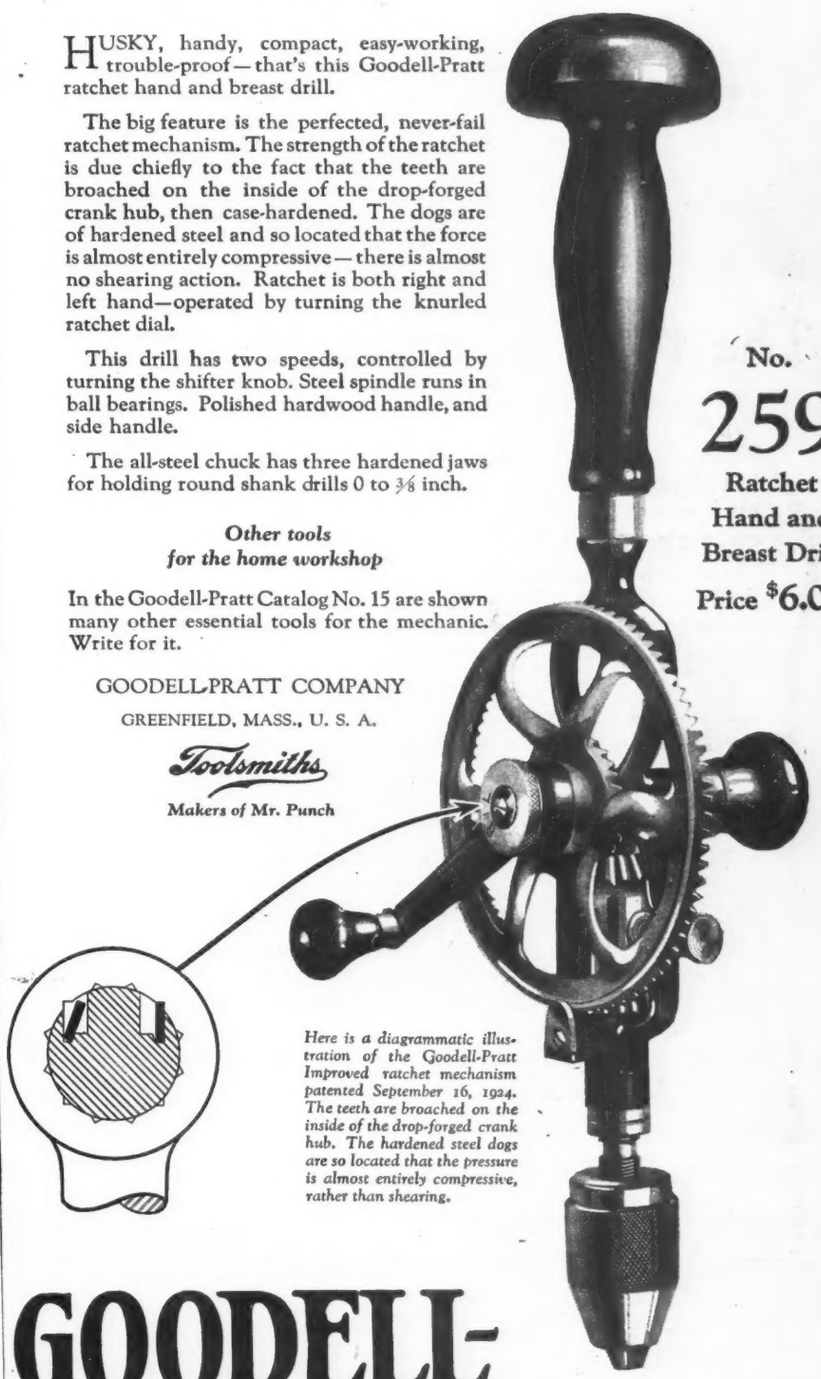
In the Goodell-Pratt Catalog No. 15 are shown many other essential tools for the mechanic. Write for it.

GOODELL-PRATT COMPANY

GREENFIELD, MASS., U. S. A.

*Toolsmiths*

*Makers of Mr. Punch*



No. 259 Ratchet Hand and Breast Drill Price $6.00

*Here is a diagrammatic illustration of the Goodell-Pratt Improved ratchet mechanism patented September 16, 1924. The teeth are broached on the inside of the drop-forged crank hub. The hardened steel dogs are so located that the pressure is almost entirely compressive, rather than shearing.*

GOODELL-PRATT

1500 GOOD TOOLS

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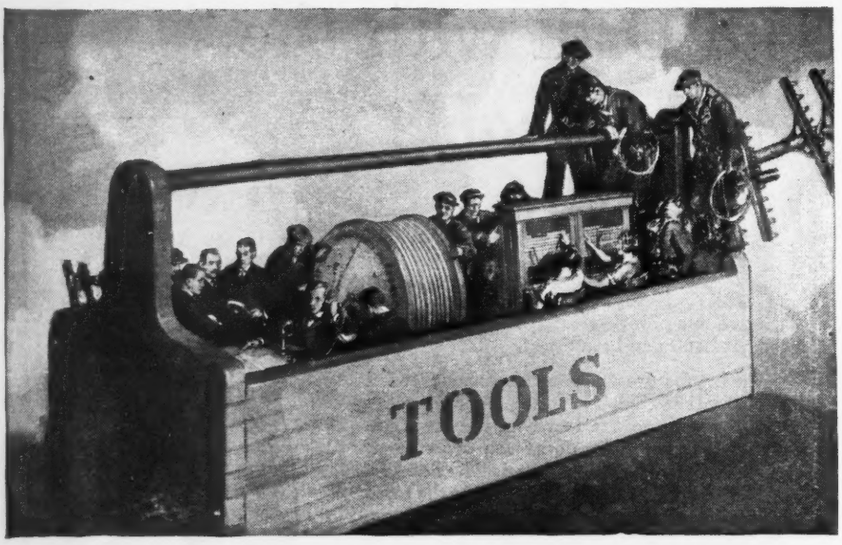



# The tools of national service

The American people lead the world in the efficiency of industry. Who can say what part of their success is due to the superior implements they use. This much we know. They have the world's best telephone system as an instrument of communication, and they use it without parallel among the races of the earth. To this end our telephone service must be equipped with proper tools.

The tools of management. Bell System executives, rising from the ranks of those who know telephony, must share our responsibility to the public, most of whom are telephone users, shareholders or workers.

The tools of service. The national, two-billion-dollar Bell System, handling fifty-eight million telephone calls a day, must be enlarged and extended while in use.

The tools of forecast. We must continue to know the rapid and complex growth of communities and make provision in advance, so that the telephone will be ready when needed.

The tools of supply. The Western Electric Company, our manufacturing and purchasing department, its factories manned by 40,000 workers, assures us that extension of facilities need never be interrupted.

We must have the best tools of finance, of invention, of everything else, in order to continue serving the American people.

AMERICAN TELEPHONE AND TELEGRAPH COMPANY
AND ASSOCIATED COMPANIES
BELL SYSTEM
*One Policy, One System, Universal Service*

SAVE at factory SALE

Combination Ranges $59.80 Up

Get manufacturer's prices. Save 1-4 to 1-2 on stoves, ranges, furnaces, and household goods during the greatest sale in our 25 years' history. Cash or easy payments—terms as low as $3 monthly. Money-back guarantee. 24-hour shipments. 30 days' trial in your home. 530,000 customers endorse Kalamazoo quality.

Kalamazoo Stove Co., Mfrs. 781 Rochester Ave. Kalamazoo, Mich.

Send for FREE BOOK

"A Kalamazoo Direct to You"

Graham Made $100. a Week Part Time

Two previously inexperienced men in widely separated parts of the country make this extra money for themselves only by fast sales and good profit on each sale. Then there is F. Depries, who averages $7,000 a year, Rober of Va., whose $500 a month is very different from the $40 a week he made at a poorly paid clerking job. We have clerks, factory workers, salesmen and others on the Fyr-Fyter sales force cashing in on one of the most lucrative propositions.

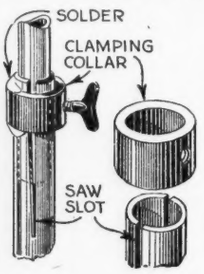
Fyr-Fyters sell like the proverbial hot cakes. We have a vacancy for you if you have enough ambition and determination to write us. No experience or investment necessary.

*Address* The FYR-FYTER CO., 648 Fyr-Fyter Bldg., Dayton, O.

## The Home Workshop

### How to Make a Simple Clamp for Cylindrical Parts

IN MAKING up some store fixtures for display purposes, the owner of a small sheet-metal shop had to devise a method for adjusting the stands up and down. The standards were of brass tubing and a setscrew was not practical. The mechanic finally adopted the means illustrated.




A clamp useful for many purposes

He slit the exterior section of the tubing, cut a sleeve from pipe, tapped it for a setscrew and attached it to the tubing with solder at the side opposite the setscrew.

The same method could be used for holding drills when a chuck is not available, or in connection with a tool handle for miscellaneous uses.

### Extra Water Pan Improves "Pipeless" Heating Plant

IN A hot-air heating system, especially the pipeless type, the usual water pan seldom supplies sufficient moisture. Realizing this, the writer tried out various schemes for increasing the moisture in the heated air. The method eventually adopted gives a maximum of moisture and the water pan is filled without going down cellar.

The humidifier can be installed quickly by any one handy with plumber's tools. It will prove a paying investment in better living conditions and reduced fuel expense, because a high humidity means that less heat is required to keep warm.

Lift the center of the floor register so the heat radiator of the furnace is exposed. With an iron strap fasten a good-sized water pan over the center of the radiator by means of machine screws. These can be threaded into holes tapped in the top of the register. Placing a bit of furnace cement on the screw before threading it in will check any possible escape of gas.

An extra large furnace humidifier

Next, cut two small holes through the two casings of the furnace, close under the floor. Attach a ⅛-in. pipe to the main water pipe, run it through the casing and lead it down to the pan as shown, by means of elbows and short lengths. Insert a valve in the line at a point where a turning rod can be brought conveniently through the floor and operated from above. Be sure and provide a key or other safeguard so the valve cannot be turned on accidentally and the furnace pit flooded. The pan can be watched during filling by looking down through the floor register.—L. R.

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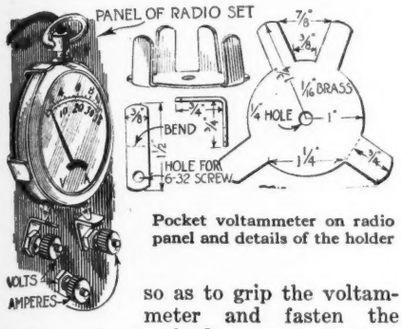
## The Home Workshop

### Clamp Holds Voltammeter on Face of Radio Panel

IF YOU use a voltammeter in connection with your radio set, you can keep it handy by mounting it on the panel as shown below.

Cut out the clamp with tinner's snips from 1/16-in. sheet brass and drill the center hole, countersinking it to take a flat-head machine screw. Bend the arms



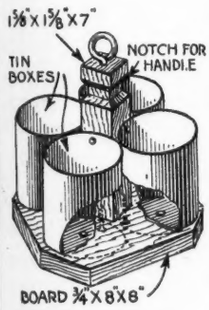

Pocket voltammeter on radio panel and details of the holder

so as to grip the voltammeter and fasten the holder to the panel wherever convenient.

Two binding posts and two small angles are used for making contact with the volt and ampere terminals; the third binding post, which is common to both sides of the meter, is connected behind the panel with the screw that holds the clamp.—PHILIPPE A. JUDD, Portsmouth, Ohio.

### Light, Handy Nail Box Made from Old Tobacco Tins

MADE from empty ½-lb. tobacco tins with rolled edges, the combination nail box illustrated is a handy and time-saving container for the home workshop. It is useful also for carpenters, especially finishers on trim and interior woodwork.




An aid in keeping nails sorted

The baseboard is nailed to the handle stick, as shown, and the tins are nailed or screwed to the base. A nail through the top of each tin into the handle further reinforces the construction.

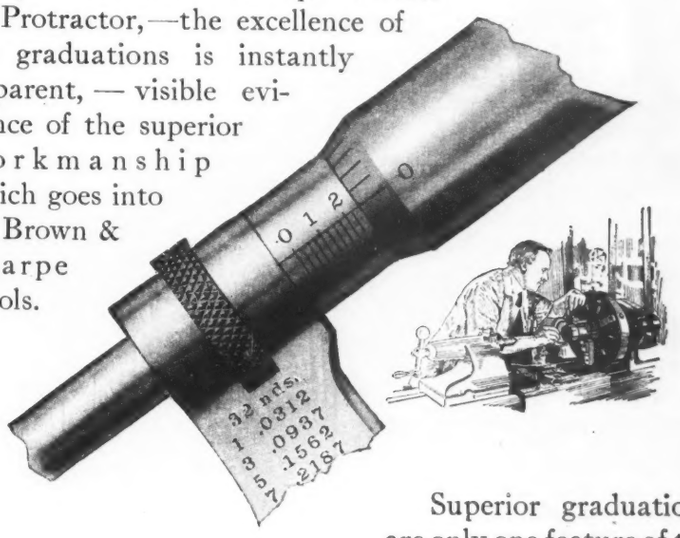
Several of these containers may be made, or more than four tins can be placed on a single base if preferred. Provide a convenient place to hang up the nail boxes when not in use and don't leave them out in the rain.—R. M. REKERT, Regina, Sask., Canada.

### Fitting Tool Handles Quickly with a Grinding Wheel

MUCH laborious whittling and shaving on hardwood handles can be avoided and a snug fit easily obtained by cutting down the handle to size on a coarse grinding wheel. This method seems to be little known, judging from the number of men who use a slower method.


# Mechanics Know They Measure Closer With a BROWN & SHARPE —*Accurate Graduations*—

Examine a Brown & Sharpe Micrometer. Notice how accurately the graduations on the thimble line up with those on the barrel. Turn the thimble. See how easily and accurately the clean cut graduations can be read. Or study a Brown & Sharpe Vernier or Protractor,—the excellence of its graduations is instantly apparent, — visible evidence of the superior workmanship which goes into all Brown & Sharpe Tools.




Superior graduations are only one feature of the mechanical excellence of Brown & Sharpe Tools,—a real excellence which makes them do better work for the man who owns them.

You ought to have Brown & Sharpe Small Tool Catalog No. 29 which lists over 2,000 of the best tools you can buy. It's sent free to any address.

**Brown & Sharpe Mfg. Co.,**
**Providence, R. I., U. S. A.**

IS

**BROWN & SHARPE TOOLS**

*"Standard of the Mechanical World"*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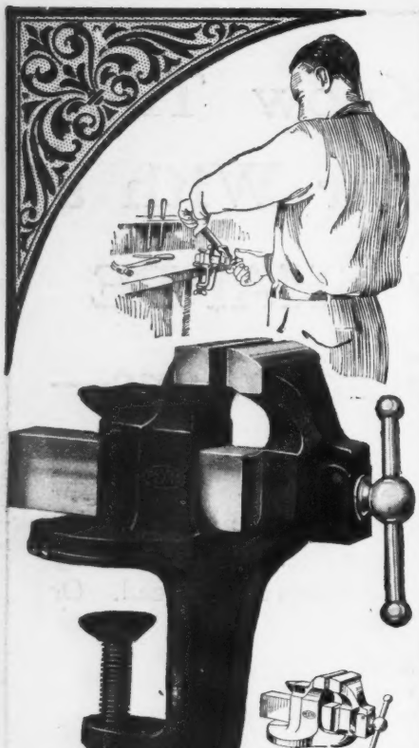


Swivel Base

Clamp Base

ASK your hardware dealer to show you these new Pexto Bench Vises—they have new patented construction and are made from new patterns thruout.

These Pexto Vises are made in sizes 1½" to 3" jaws, with clamp or swivel base, iron or steel faced jaws—in fact you will find just the style and size to meet your requirements. They are attractively finished in gray with polished jaws and anvil.

Your dealer can show you these Vises along with other Pexto Mechanics' Hand Tools—tools that you need in the home or garage—such as Braces, Bits, Hammers, Hatchets, Pliers, Wrenches, Chisels, Draw Knives, Snips, etc.

Another thing—you can't go wrong on Pexto Tools as they are backed by a century of tool making experience and are a combination of skillful workmanship and materials of quality.

PEXTO

Worth While Tools

PECK STOW & WILCOX CO.
SOUTHINGTON, CONN.

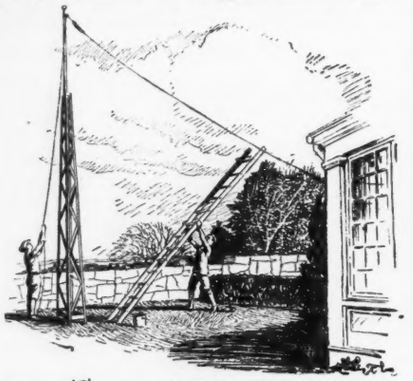

## The Home Workshop

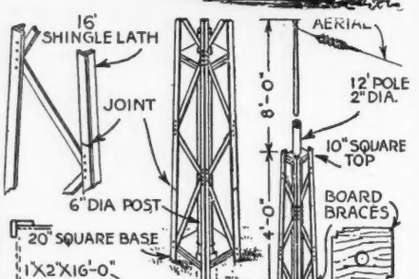
### Building an Aerial Mast that Requires No Guy Wires

THE radio fan often can improve the volume and range of his receiving set to the equivalent of one or two additional tubes by constructing a fairly high outside aerial.

The only problem to be solved is in the erection of a neat, strong mast for supporting the far end of the antenna; the near end can be fastened to the house.

One of the best masts is that illustrated. Although 28 ft. high, it is easy to build, costs little for materials, requires no guy wires, and is much more workmanlike in appearance as well as cheaper than a solid wooden pole of similar height. The fact that it resembles in appearance the steel






Rough spruce shingle laths, 16 ft. long, are used in constructing this rigid antenna pole

work commonly used for supporting the aerials of broadcasting stations is another point in its favor; it is distinctively a radio mast.

To build it requires 20 pieces (two bundles) of 1 by 2 in. by 16 ft. rough, common wood (tough spruce shingle lath preferred); a few odd boards ⅞ in. thick; one stock flagpole about 2 in. in diameter at the base and 12 ft. long; one stock 6-in. fence or laundry post about 10 ft. long, of chestnut or other wood that will not rot readily in the ground; 3 lb. eightpenny common nails, bottle-green paint sufficient for two coats, one small galvanized iron pulley (if the flagpole is not equipped with a good pulley) and 50 ft. of sash cord.

On a sidewalk, floor, or level ground lay one 16-ft. shingle lath, and butt up against the end of it a piece 4 ft. long, skew-nailing the two together temporarily. This is to form one side of a sort of ladder that is to be 20 in. wide at the bottom and 10 in. wide at the top. For

(Continued on page 121)

No. 8 or No. 26 Bent Nose

No. 10—Thin Nose

EVERYWHERE about the home—from cellar to attic, from kitchen to garage—you will find need of a good Slip Joint Plier.

There is a style of Slip Joint Plier in the extensive Pexto line to meet your requirements—ask your dealer to show them to you—twenty styles in all and all practical sizes of each style. They are drop forged steel, carefully finished and can be had either Nickel Plated or Blued finish.

All Pexto Tools are backed by a century of tool making experience. The line consists of Bit Braces, Hammers, Chisels, Screw Drivers, Hatchets, Snips, Squares, Wrenches, Pliers, and many other small tools and it is easy to procure Pexto Tools as they are carried by practically all progressive dealers.

*Ask for Plier Booklet.*

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## The Home Workshop

### Building an Aerial Mast

(*Continued from page 120*)

the other side of the ladder use two similar pieces, but put the 4-ft. length at the opposite end from the one on the ladder leg already made.

About 1 in. from the bottom nail a 4-in. batten (or two laths) at right angles to the center line. Cut the first diagonal brace about 3 ft. long, sawing the ends at the correct bevel and making both ends alike. Lay this brace on the frame at the bottom, keeping it back from the edges ⅛ or 1 in., according to the thickness of the wood. Do not nail this, but mark and cut the next one, maintaining the same bevel cut. Lay this in position and continue until all the pieces are cut.

If the same bevel is maintained, it will be found that each piece will be shorter than the preceding one. Before nailing these in place, mark three more sets. Two eightpenny nails at each end of each brace will be amply strong enough if the nails are well clinched.

All four frames are made exactly alike with the exception that the diagonals start from left to right on two of them and from right to left on the others. In other words, they are made in pairs. Nail three sides together on the ground, overlapping only one corner of each side, so that the mast will come square.

CUT from a ⅞-in. board two pieces 9 in. square and nail them together so that the grain of one crosses that of the other. Fit the square in place at the top of the mast, cutting out two diagonally opposite corners to allow for the ends of the top braces. Then bore the piece to suit the flagpole and fasten it about 3 in. below the top of the mast.

Make a similar two-ply piece 11 in. square to fit within the sides of the mast about 4 ft. from the top. Only the upper of the two boards in this case should be bored for the flagpole, thus forming a socket or cup. Set the pole in place and fasten with a lagscrew through the bottom board, but be careful not to split the pole. Also attach the pulley and line. It will save time to paint the mast before erecting it.

Set the heavy 10-ft. fence or laundry post in the ground, preferably with cement. Then you may erect the three-sided mast around the post, seeing that it stands quite plumb. Nail short braces from the four corners of the mast to the post near the top of the latter; do the same at the bottom. Also make a shelf at the bottom upon which heavy stones may later be piled for added security. The last side then may be raised and nailed in place.

The mast, if properly built, will stand firmly enough to allow a ladder to be placed against it, so that it can be repainted whenever necessary. Wedges should be used to tighten the flagpole where it passes through the top of the mast.

Incidentally, the aerial can be lowered and a flag raised upon occasion. It is also possible to use the mast for supporting a long pulley clothesline, as the construction is astonishingly rigid.—A. E. E.

Come to cutting tool headquarters for metal cutting saws

It is a significant fact that organizations that depend upon cutting tools most, invariably turn to Simonds—first, for saw engineering service and for general saw information and, finally, for the saws themselves. All Simonds saws are made from steel produced in Simonds plants from an exclusive formula. Bring *YOUR* saw problems to Cutting Tool Headquarters. Ⓢ

*Simonds produces solid or inserted metal tooth cutting saws, slitting and slotting saws—made with any standard style tooth to fit any machine.*

SIMONDS

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SAWS FILES KNIVES STEEL

SIMONDS SAW AND STEEL COMPANY

Fitchburg, Mass.

"The Saw Makers" Established 1832

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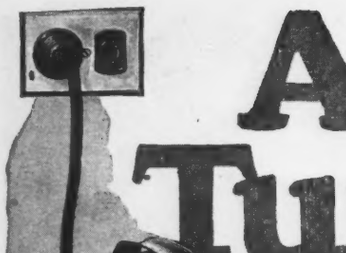


# A new Tungar!

The *new* Tungar does all the old Tungar did—and more. It will charge both radio A and B batteries, with no change except slipping the wire from one terminal to another. It charges 2, 4 or 6 volt A batteries—24 to 96 volt B batteries—and auto batteries, too.

It is simpler than ever to use. Just two clips and a plug. No need to disconnect your battery from your set, or make any change in the wiring. The Tungar charges overnight while you sleep. And it makes no disturbing noise.

It is more compact than ever. It has a new bulb, unchanged in principle, but more convenient in size and use. G-E research has made a good product better!

Keep your batteries charged with a Tungar—and get the most out of radio.

**300,000 Tungars already in use!**

The new Tungar charges both radio A and B batteries, and auto batteries, too. Two ampere size (East of the Rockies) $18

The Tungar is also available in five ampere size (East of the Rockies). $28

*60 cycles—110 volts*

**Tungar**
REG. U. S. PAT. OFF.
BATTERY CHARGER

*Tungar—a registered trademark—is found only on the genuine. Look for it on the name plate.*

*Merchandise Department,*
*General Electric Company,*
*Bridgeport, Conn.*

# GENERAL ELECTRIC


## The Home Workshop

### Removable Seat Cushions

(*Continued from page 96*)

the stuffing into place. The reason is the same as that for tying a quilt, only with a thick cushion such as we have made, we cannot take a stitch clear through. Besides, we need more strength, so we use tufting buttons, as in Fig. 7.

You may have any number of buttons you choose and locate them as you desire. Regular tufting twine or strong fishline should be used. Thread a long needle and force it through the cushion so that it comes through at a corresponding point on the opposite side. Run the thread through the eye of the tufting button and return your needle through the same holes you used before. Now thread on another button and remove your needle.

In order to draw the buttons together as shown in Fig. 7, a special knot must be tied. Figure 12 shows the method. The purpose is to form a slip knot that will allow you to draw the buttons up snugly to the covering on both surfaces.

How your twine will look when you are ready to tie the knot is shown at *A*. The short end is held in the left hand, the long end in the palm of the right hand, with the index finger reaching out to grasp or hook this strand. This strand is shown at *B* drawn under the first and an upward turn begun; *C* shows this turn completed, the loop being drawn over the top and to the left of the short end, which still is held in the left hand.

Now take this left end, move over the two strands and come *up* through the triangle already formed. Notice *D*. The loop held by the right index finger is released. Still holding the short end, slide the knot thus formed into place and draw the buttons together. When this is done, a sharp pull on the short strand will draw out the knot in such a manner as to make a secure job. A common square knot is then tied around the shank of the button and the ends of the twine are trimmed off short enough so as not to show beyond the edge of the button.

If you use buttons with a cloth shank, it will be necessary to stitch through this instead of through the eye of a hard button as described. The knot is tied in the same manner.

In making a wedge cushion, it is well to cut out the front, back, and end all in one long piece. Cut the triangular ends separately and do the stuffing from the narrow edge.

### Starting a Cold Engine

ANY one who has had the experience of cranking a Ford motor for half an hour or more when the thermometer is around zero should make a practice of, leaving the emergency brake lever down in running position at night. This squeezes out all oil between the bands and the drums and prevents any from getting in until the motor is started again.

In the morning draw the brake lever back in starting position and the motor will be found to turn over very much easier, because of the absence of congealed oil between the bands and the drums.—H. W.

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SMALL CAPITAL STARTS YOU
Big opportunity to become independent. No experience needed. We show you how. Our easy payment plan makes it easy to start. We equip you complete (our machines used and endorsed by government institutions. Write today for free catalog.
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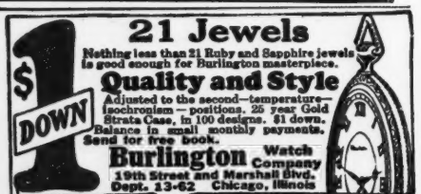
536 S. Dearborn St., Dept. 77, Chicago
Our Catalog Free Shows You how to Earn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Nothing less than 21 Ruby and Sapphire jewels is good enough for Burlington masterpiece.
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is valuable to
MACHINISTS and TOOLMAKERS
Saves its cost many times in value of tools it saves from loss and damage. Write for free catalog.
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"WONDER" COLD PIPE,
TUBING & BAR BENDERS
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14 Sizes of Machines
What it costs to bend pipe our way. Per bend.
1" pipe 5 cents 4" pipe 25 cents
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AMERICAN PIPE BENDING MACHINE CO.
51 Pearl St. Boston, Mass.

## The Home Workshop

### Beautiful Chest Easily Made

(*Continued from page 94*)

*B* End of frame under top (mitered), ⅞ by 2½ by 21½, 2 required.
*C* Front of frame under top (mitered), ⅞ by 2½ by 41, 1 required.
*D* Back of frame under top, ⅞ by 1¾ by 36, whitewood, 1 required.
*E* Ends of case, ⅝ by 20⅛ by 30¼, plywood, 2 required.
*F* Front stiles, ⅞ by 2½ by 30¼, 2 required.
*G* Top front fillings, ⅞ by ⅞ by 1½, 2 required.
*H* Bottom front fillings, ⅞ by ⅞ by 3¼, 2 required.
*I* Quarter turnings (stock design), ⅞ by ⅞ by 1 1/16, 4 required.
*J* Quarter round moldings, ⅞ by ⅞ by 23⅜, 2 required.
*K* Drawer rails, ⅞ by 2½ by 36½, 4 required.
*L* Drawer-top division, ⅞ by 1½ by 6, 1 required.
*M* Top-drawer fronts, ⅜ by 6 by 17½, plywood, 2 required.
*N* Second-drawer front, ⅜ by 6 by 36½, plywood, 1 required.
*O* Third- and fourth-drawer fronts, ⅜ by 7 by 36½, plywood, 2 required.
*P* Drawer-front backings (used with *O*), ½ by 7 by 35½, whitewood, 2 required.
*Q* Drawer-front backing (used with *N*), ½ by 6 by 35½, whitewood, 1 required.
*R* Drawer-front backings (used with *M*), ½ by 6 by 16½, whitewood, 2 required.
*S* Third- and fourth-drawer sides, ½ by 7 by 18, whitewood, 4 required.
*T* Top- and second-drawer sides, ½ by 6 by 18, whitewood, 6 required.
*U* Third- and fourth-drawer backs, ½ by 6⅛ by 35½, whitewood, 2 required.
*V* Second-drawer back, ½ by 5⅛ by 35½, whitewood, 1 required.
*W* Top-drawer backs, ½ by 5⅛ by 16½, whitewood, 2 required.
*X* Second-, third-, and fourth-drawer bottoms, ¼ by 18 by 35½, plywood, 3 required.
*Y* Top-drawer bottoms, ½ by 18 by 16½, plywood, 2 required.
*Z* Back of case, ⅜ by 38¼ by 31⅛, plywood, 1 required.
*AA* Drawer runners, ⅞ by 1½ by 18⅛, poplar (or other inexpensive wood), 10 required.
*BB* Drawer guides, ½ by ⅞ by 18⅛, poplar, 10 required.
*CC* Center division between top drawers, ⅞ by 6 by 19¾ (or 18 or thereabouts), poplar, 1 required.
*DD* Division under *CC*, ⅞ by 2½ by 19¾, poplar, 1 required.
*EE* Base front, mitered, ¼ by 1⅝ by 40½, 1 required.
*FF* Base ends, mitered, ¼ by 1⅝ by 21¼, 2 required.
*GG* Feet (stock design), 4 in. long, 4 required.
*HH* Filling for all drawers, ⅜ by ½ by 36, whitewood, 12 required.
*II* Filling molding, quarter round, ⅜ by ⅜ by 36, whitewood, 12 required.
*JJ* Dowels or double-end screws for feet, 5/16 by 3, 4 required.
*KK* Drawer-back strips, ½ by ½ by 6, poplar, 10 required.
Antique handles, 2½ by 3¾, brass, 8 required (or glass knobs).
Escutcheons, brass, 3 required.
Locks, ⅞ to center, 3 required (if wanted).
Screws and nails; best glue.

PLYWOOD or veneered stock is used so widely now and is such a desirable material for the amateur craftsman that it will pay you to make every effort to obtain it for use where specified in this list. If, however, you cannot get it, or the price seems unreasonably high, you can substitute solid stock for the top, ends and drawer fronts, and tongued-and-grooved stock of any available kind for the back.

Lacking plywood for the top, you will find that you cannot get a single board wide enough to make the top in one piece. If your lumber dealer operates a planing mill, you will be able to have the top glued up and cut to size for you. This will save considerable work and be well worth while.

You can, however, do the same work yourself without much trouble. Match two or three of your best pieces to make the top and bore into the joining edges for about six ⅜-in. dowels. Run a plane over the dowels so there will be a narrow

(*Continued on page 124*)

10 Shaves Free
Send Coupon

# We've Won Millions

***to this unique shaving cream; please try it—5 new joys await you***

GENTLEMEN:

Palmolive Shaving Cream is a national sensation. Men have flocked to it by the millions.

80% of its users once were wedded to other shaving creams. Only outstanding and superlative advantages could have won them over.

## 60 years of mastery

We are experts in soap-making. For 60 years we have been improving soap.

We asked 1000 men what they most desired in shaving lather. We spent 18 months in modern laboratory work. 130 formulas were discarded before we found the right one.

Then we offered men a test. And that test changed the shaving cream situation; made a new leader in the field.

## Find out—please

Palmolive Shaving Cream may or may not meet your ideals.

So in fairness both to you and us, won't you put your present cream aside a few days and give Palmolive Shaving Cream a trial? Simply mail the coupon.

We'll thank you for the courtesy, and you'll thank us, we believe, for the new conception of shaving comfort that it brings.

## Five remarkable results

**5 *delights***

1 **Multiplies itself in lather 250 times.**
2 **Softens the beard in one minute.**
3 **Maintains its creamy fullness 10 minutes on the face.**
4 **Strong bubbles hold the hairs erect for cutting.**
5 **Fine after-effects, due to the palm and olive oil content.**

To add the final touch to shaving luxury, we have created Palmolive After Shaving Talc—especially for men. Doesn't show. Leaves the skin smooth and fresh, and gives that well groomed look. We send a sample free with the tube of Shaving Cream.

THE PALMOLIVE COMPANY (Del. Corp.) Chicago, Ill.

## PALMOLIVE SHAVING CREAM

**10 SHAVES FREE**
**and a can of Palmolive After Shaving Talc**

Simply insert your name and address and mail to Dept. B943. Address for residents of Wisconsin, The Palmolive Company (Wis. Corp.), Milwaukee, Wis., Address for residents other than Wisconsin, The Palmolive Company (Del. Corp.), 3702 Iron St., Chicago, Ill.

2679


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# Electrical Energy

**Columbia**
**EVEREADY**
**Dry Batteries**
*–they last longer*

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- doorbells
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- starting Fords
- ringing burglar alarms
- protecting bank vaults
- electric clocks
- calling Pullman porters
- firing blasts
- lighting tents and outbuildings
- running toys
- radio "A"

Don't just ask for "a dry cell." Ask for Columbia Eveready Dry Batteries by name and get 100% battery efficiency. Columbia Eveready Dry Batteries are sold by electrical, hardware and auto accessory shops, marine supply dealers, radio and implement dealers, garages and general stores. Columbia Eveready Ignitors can be purchased equipped with Fahnestock spring clip binding posts at no extra cost to you.

COLUMBIA Evereadys furnish power and pep for a thousand and one tasks. Everything from workaday tasks like ringing the doorbell and starting the Ford, to running toys for the children and providing current for inventors and experimenters.

For more than thirty years Columbia Evereadys have been known for their abundance of electrical energy. They are better than ever—they last longer.

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**Tool Cases**

for Machinists, Carpenters and Tool Makers; none better; thirty styles. Quartered oak and metal covered. Ask for booklet.

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***Flies Without Motor***
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Book giving detailed instructions and license under Pat. No. 1499232 enabling anyone to build one of these wonderful gliders 5 feet long, and information about contest in which you may win a silver cup, sent postpaid for 54 cents. Send for it today.

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Make your car look like new and save a big labor bill. We have been making top recoverings, side curtains and seat covers for 15 years. We have patterns for all makes, no model too old for us. Easy to apply, simple instructions given. Write for our big money saving catalogue with samples.

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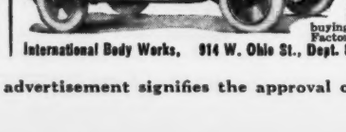
**RADIO SETS—AUTO BODIES**
**SEND FOR THE INTERNATIONAL CATALOG**



Our net price list. Full line of Radio Sets; and auto bodies for Fords at *Wholesale Prices*. Save big money by buying Direct from Factory.

International Body Works, 914 W. Ohio St., Dept. 8, Chicago, Ill.


## The Home Workshop

### Beautiful Chest Easily Made

(*Continued from page 123*)

flat side on each to allow the glue and air to escape when the boards are forced together. Be sure not to have the dowels too long; they should be at least ⅛ in. shorter than the total depth of the holes on each side of the joints. Apply hot glue or first-class liquid glue warmed in a dish of hot water to the dowel holes and edges and force the pieces together between strips nailed on the bench or the workshop floor. Use wooden wedges to exert pressure. If you have regular cabinet clamps, so much the better.

YOU will have no difficulty in obtaining the quarter-round molding for the front corners of the case. The little turnings at the top and bottom are stock designs, but if you cannot obtain them or have them made specially, get turnings from a discarded piece of furniture or a new stair-baluster, or anything that you can adapt for use as the cap and base for the quarter-round pilasters.

The same suggestions apply to the feet. They are a stock design, but if you cannot buy them, get feet from a discarded piece of furniture; inquire at your local cabinetmaker's, in case he may have something to serve your purpose, or glue up blocks of the right size and carve them out yourself. If some of the chisel marks show and if the four feet do not match exactly—if they are not as perfect as machine carvings—it is just as well. From the viewpoint of the furniture connoisseur, they will be all the more attractive.

In other words, to build even so simple a piece as this requires a certain amount of ingenuity and perseverance, but that is half the fun.

To understand the construction, simply imagine the case with the drawers, the ends and the quarter-round ornaments all removed. You have left a framework made mainly of strips ⅞ by 2½ in., held together with glue and nails. If you cannot get a large sheet of 3- or 5-ply veneer for the back, you will have to strengthen the frame by adding back members, to which the back boards can be fastened.

AFTER the framework is complete, the end pieces are screwed on from the inside. The quarter-round pilasters then are glued in place.

A frame mitered at the front corners is made for the top of the case. To this frame the top proper is fastened by means of screws from underneath. All these details are made clear in the working drawings on page 94.

If the chest is too large for the room in which it is to be used, or if the available wall space is not quite wide enough, you can modify any of the dimensions to suit.

The chest may be finished to match other furniture, or in any way desired. A good method is to stain the wood and fill it with a paste filler of first-class quality. Give it a very thin coat of shellac and then follow with three or four coats of shellac very little thicker than the first wash coat. Each coat should be rubbed

(*Continued on page 125*)

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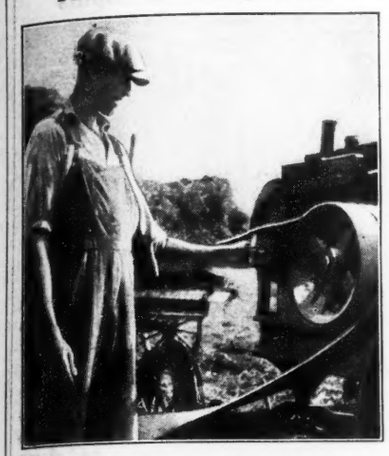
## The Home Workshop

### Old Inner Tube Used to Dress Farm Machinery Belts



TO DRESS farm machinery belts, an Iowa farmer folds a piece of inner tube, heats it at the tractor exhaust until it is soft, and rubs the melted end on the under side of the belts.—F. L. CLARK.

### Beautiful Chest Easily Made

(*Continued from page 124*)

lightly with pumice-stone and oil, or with very fine sandpaper (00 or finer), moistened with oil. You can obtain a so-called "wet" sandpaper that is especially good for this purpose. Finish with several coats of furniture wax applied thin and rubbed in vigorously.

A word might be added on concealing blemishes. Even in furniture factories it is often necessary to hide defects in the wood and repair mishaps. The amateur almost always has to do some "doctoring" to his work, but unfortunately does not know how to do it successfully.

In the first place, cracks and holes always can be filled with fine sawdust or wood file dust mixed with thin glue. Better than this, however, is a prepared wood paste now on the market which can be squeezed into any holes or shallow depressions, and even molded to replace broken edges of carvings or moldings. When dry, it may be sandpapered, planed, cut, or even nailed into, just like wood, and it finishes like wood.

During the course of finishing and afterward, it is possible to conceal many kinds of damages with stick shellac, applied with a warm soldering iron or old chisel. Stick shellac can be obtained at any large paint store in colors, both transparent and opaque, to match any kind of finish.

It would be quite possible, of course, to make this chest of drawers of a relatively soft wood, such as whitewood, and paint it. In that case, glass knobs might be used instead of antique pulls. Any holes and cracks may be filled with putty after the priming coat is on. White lead putty is preferable to ordinary whiting putty. You can make some yourself when necessary simply by buying 10 cents' worth of powdered white lead at the paint store and mixing it with ordinary putty and boiled linseed oil to the consistency desired.


# Type 6-D Broadcast Receiver

*Non-oscillating ~ Non-radiating*

IN dollar-for-dollar value, the 6-D Receiver leads the field.

This remarkable Receiver excels in every phase of performance—purity of tone, sharpness of tuning, range, volume and ease of operation.

You can pay more, but you cannot buy better reception. By all means, examine the 6-D before making a final selection.

**Price $125.00**
**without accessories**

EISEMANN MAGNETO CORPORATION
165 Broadway, New York
DETROIT SAN FRANCISCO CHICAGO

SPECIFICATIONS

*Circuit:* Two stages of tuned radio frequency amplification, detector and two stages of audio frequency amplification. Non-oscillating.

*Tubes:* Five in all. Jacks provided for either five or four tube operation.

*Batteries:* Either storage or dry-cells.

*Cables:* Complete set supplied for "A" and "B" batteries.

*Wave lengths:* 200 to 600 meters, with uniform efficiency of reception.

*Aerial:* 75 to 125 feet, single wire.

*Panel:* Aluminum, with attractive crystal black finish. A perfect body capacity shield.

*Dials:* Sunken design. Shaped to fit the hand and permit a natural position in tuning.

*Condensers:* Single bearing, low leakage losses.

*Sockets:* Suspended on cushion springs which absorb vibrations.

*Cabinet:* Mahogany, with distinctive lines and high finish. Ample space provided for "B" batteries.

EISEMANN

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ELECTRICAL EQUIPMENT

Tested and Listed as Standard by Underwriters' Laboratories

U. S. Patent 1,496,582

The FANSTEEL Balkite Battery Charger

*does not create disturbances in your set or your neighbor's*

The Balkite Battery Charger is entirely noiseless. It can be used while the radio set is in use. It has no moving parts, vibrators or bulbs, and has nothing to break, adjust or get out of order. It is simple and unfailing in operation. It cannot discharge, short-circuit or damage the battery by overcharging. Besides charging "A" batteries it will also charge "B" batteries of the lead type in multiples of 6 cells. *Sold by all leading radio dealers.*

PRICE $19.50

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*Manufactured by* FANSTEEL PRODUCTS CO., Inc., North Chicago, Ill.

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Does Everything in Woodworking

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*11 inch Band saw*
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*Shaper*
*10 inch sander*
*lathe—14 inch swing*

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It is a band saw, shaper, lathe—all in one. You can do sawing, rabbetting, planing, moulding, matching, panel raising. Just the thing for your home shop! You can order it complete or with just the attachments you want.

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BUILD YOUR OWN RADIO SET

All complete parts for the following sets consist of standard advertised guaranteed parts and include drilled bakelite panels and wiring diagrams for easy set construction.

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|---|---|
| Ultra Audion Circuit | $ 8.95 |
| Five Tube Licensed Neutrodyne | 33.75 |
| One Tube Cockaday | 10.45 |
| Three Tube Cockaday | 19.95 |
| Eight Tube Superheterodyne | 59.75 |
| One Tube Reflex | 15.85 |
| Two Tube Reflex | 20.55 |
| Three Tube Reflex | 27.85 |
| Four Tube Acme Reflex | 39.85 |
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| Two Stage Amplifier | 10.90 |

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Our radio engineers will help you solve all your radio problems, and furnish up-to-date information on set construction, operation and improvement. This service is free to our customers.

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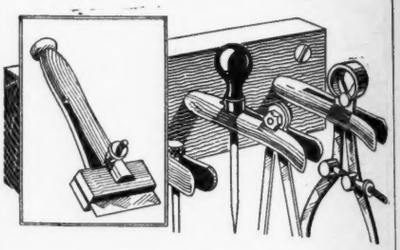
HEADPHONES
"Randolph Special"
2200 Ohm moulded headset

RANDOLPH RADIO CORP.
159 N. UNION AV. Dept. 343 CHICAGO, ILL.

## The Home Workshop

### Tool Rack and Scraper Handle Made from Clothespins



BY DRIVING headless clothespins into holes bored in a ¾-in. board, it is possible to make a handy tool-rack for small tools.

A clothespin also makes a good handle for a safety-razor blade. Whittle the ends to fit two small blocks, as shown, place the blade between the blocks, and clamp tightly with a machine screw and thumbnut.—F. N. C.

### Cutting an Arched Opening

(*Continued from page 104*)

keeping the grain in the direction of the curve as much as possible. Nail the pieces into position under the head trimmer.

"Fur" or strip the sides of the brace planks (if planks have been used) to the width of the studding and lath up, trimming the ends to conform to the curve. Then cross-lath around the curve and sides, and bend around the curve a strip of No. 18 gage, 1-in.-mesh chicken wire, or light metal lath, if available. Nail metal corners to the edges of the opening, plumbing them carefully and keeping them square with the wall. Cut out the old plate across the bottom of the opening. The arch is now ready for plastering.

If it is desired to avoid the expense of plastering, cover the lath with plaster board made of wood fiber, so that a strip of it can be bent about the under side of the arch without breaking. In this event, the lath may need shimming out with thin strips so that the wallboard, which is generally thinner than plaster, will be flush with the old plastered wall.

The patching of the floor is the most difficult task of all. If the floor is hard wood, the neatest way to patch is to chisel or saw off the ends on each side of the opening, provided the boards run crosswise of the partition. This forms a rectangle, around which a strip may be mitered to form a border. Boards laid in the same direction as the floor fill in the remaining space.

With a soft-wood floor, cut off the ends in the same way and fill in without a border. Bevel the ends of the boards so that they will form very tight joints when driven down. Nail from the top with six-penny finishing nails.

The arch and floor completed, replace the baseboards by mitering around the sides of the arch, and bring the picture molding to the edges, returning it upon itself, as shown.

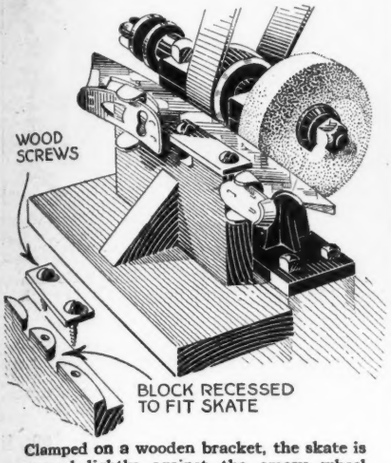
Paper the inside of the arch with a neutral color that will harmonize with the paper in both rooms.

## The Home Workshop

### How to Hollow Grind Your Ice Skates Easily

IF AN ordinary emery wheel is available, it is the work of only a few minutes to make the wooden jig, or bracket shown, on which ice skates can be clamped for sharpening.

Care should be taken that when the skate is clamped in position, as illustrated, the center of the skate edge is




**Clamped on a wooden bracket, the skate is pressed lightly against the emery wheel**

on a level with the center of the wheel.

The bracket, with the skate clamped on it, is slid along the top of the bench, the blade being pressed lightly against the grinding wheel. Don't try to take off too much stock, but make several complete passes from point to heel of blade and back again.

The smaller the diameter of wheel used, the more concave, of course, will be the skate edge.—F. S. ROOT, Fall River, Mass.

### Dutch Crafts Hall Chair

(*Continued from page 100*)

on the ends of it with beveled shoulders to correspond to the slant of *C* and *D* in the finished chair. Cut corresponding mortises in pieces *C* and *D* 5 in. from their top ends and fit the parts together. Key seats are cut near the ends of the tenons and the keys, *H*, ½ in. square and 2 in. long, are driven in.

The cleats, *F*, 1 by ¾ by 8 in., are bored for 1½-in. screws, and beveled with the top ends of *C* and *D* so that all will fit flush against the bottom of the seat, *A*, to which they are screwed. Figures *C* and *D* are 11½ in. apart at the top and 16 in. apart at the bottom.

The braces, *G*, are 2 in. at the widest part. They are screwed to *B* and *C* with 10 round-headed screws, which vary in length from ¾ to 1½ in. Glue may be used in the joints, although screws alone will make a rigid chair and one that may be taken apart.

Any standard stain may be used. The chair shown was colored with a dye made by mixing chrome green with gasoline and darkening it with lampblack. It was well rubbed and, when dry, finished with wax. A flat varnish also gives an appropriate finish on pieces of this character; glossy finishes should be avoided.—J. T. GARVER, Huntingdon, Tenn.

*Insist on the Gold Seal HOMCHARGER $18.50 at your dealer (in Canada $26).*

GENUINE GOLD SEAL HOMCHARGER REG. UNQUALIFIEDLY GUARANTEED

# You needn't have "battery trouble"

## 14 Gold Seal HOMCHARGER Features

1—Simple; needs no care.

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3—Quick; brings battery up to full charge overnight.

4—Tapers charge; cannot injure the battery.

5—Clean; no bulbs to break, no liquids to spill or produce fumes.

6—Dependable; adjusted and sealed at factory.

7—Lasts forever; only one moving part, the Tungsten contact, which can be replaced at $1 after many thousands of hours of use.

8—Fool-proof; charges automatically, no matter which clip is attached to which battery terminal.

9—Safe; approved by Fire Insurance Underwriters. No danger of shock or fire.

10—Beautiful; sturdy metal case finished in mahogany-red and gold.

11—Universal; made in types for all voltages of alternating and direct current. Charges all radio "A" and "B" batteries, and automobile batteries.

12—Quiet; its faint hum cannot be heard in next room.

13—Unqualifiedly guaranteed.

14—Popular price—sold everywhere for $18.50; in Canada $26. Complete, no extras to buy.

**TWO things will make your enjoyment of radio free from battery trouble. First, any good storage battery. Second, that excellent, simple, automatic charger—the new silent Gold Seal Homcharger.**

GOLD SEAL HOMCHARGER

Such a combination means minimum care and maximum results, with no trouble at all. Then you can use your set all you want. If the battery becomes weak right in the middle of a program, screw the Homcharger plug in any lamp-socket, snap two spring clips over the battery terminals, and go right on listening at full power. Leave the Homcharger connected overnight, and in the morning the battery is charged again.

Everybody says this is the handsomest charger ever seen. The Gold Seal Homcharger is finished in mahogany-red and gold. It has rubber feet and so cannot mar polished floors, tables or cabinets. Safe—approved by the Fire Insurance Underwriters. Can't injure anything.

When buying a set, get storage battery tubes. They give most volume, and in many cases better results in distance too. Make sure the battery you buy is charged, then you can listen in for a week to a month before you buy your Gold Seal Homcharger. Price only $18.50 complete; $26 in Canada. Absolutely guaranteed.

**FREE!** Ask your dealer or send direct for our interesting free booklet, "The Secret of Distance and Volume in Radio," containing valuable information on this subject and fully describing the GOLD SEAL HOMCHARGER.

Insist on the Gold Seal Homcharger—ask your dealer.

*The* AUTOMATIC ELECTRICAL DEVICES CO.
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This 13" x 5' Quick Change Gear **South Bend** Screw Cutting **Lathe**

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This unusual offer comes to you from one of America's largest exclusive builders of Screw Cutting Lathes, established 18 years. More than 31,000 of our Lathes in use. For example, in plants of 2 largest Steel Companies, in 8 largest Auto Factories, in 5 largest Railroad Shops, in world's largest Sewing Machine Factory, in 2 largest Fire Arms Factories, by largest Oil Company, and by the U. S. Government, etc.

*Undercutting mica on an armature commutator*

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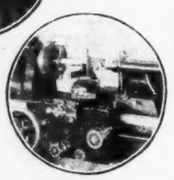

*Threading a tap*

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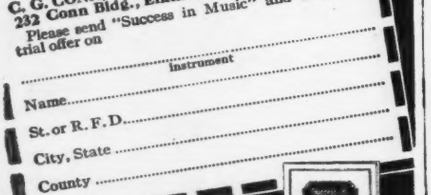

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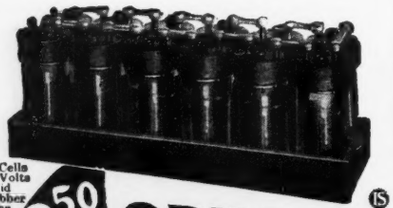

12 Cells 24 Volts Solid Rubber Case

# $3.50 COD SPECIAL

**INTRODUCTORY PRICE**

For a limited time *only*, and to introduce this new and superior Storage "B" Radio Battery to the Public, we are selling it for $3.50. Regular Retail Price is $5.50. You save $2.00 by ordering NOW. A finer battery cannot be built than the

## World Storage "B" Battery

(12 CELLS—24 VOLTS)

To ten million homes with Radio Sets—and to countless millions of prospective buyers—this WORLD Storage "B" Battery brings a new conception of battery economy and performance. Here is a battery that pays for itself in a few weeks—will last for years and can be recharged at a negligible cost. *And you save $2.00 by ordering now.*

**A *Superior* Battery Equipped With Solid Rubber Case**

Has heavy duty 2 1-8 in. x 1 in. x 1-4 in. plates and plenty of acid circulation. Extra heavy glass jars allow ready observation of charge and prevent leakage and seepage of current. It holds its charge, while idle, at constant voltage. You will find this battery a boon to long distance reception. It does away with a great many noises so often blamed on "static." Mail your order today.

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Just state number of batteries wanted and we will ship day order is received. EXTRA OFFER: 4 batteries in series (96 volts), $13.00. Pay Expressman after examining batteries. 5 per cent discount for cash in full with order. Send your order NOW and save $2.00.

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**SAVE $2.00 BY ORDERING NOW!**


## The Home Workshop

### Home Workshop Blueprints Make Furniture Building Easy

BEGINNERS in woodwork frequently write the Editor asking which furniture blueprints in the Home Workshop series are the simplest. The easiest ones are Nos. 3, 35, 37, and 39 in the list below. Their simplicity lies in the absence of difficult joints.

Number 3 has the fewest parts. Number 35 is perhaps the most elementary as it is little more difficult in construction than a box. Numbers 37 and 39 are as simple in principle, but require more time.

Samuel Riker, 3rd, of Redbank, N. J., whose handiwork is illustrated at the right, says:

End table with book trough

This is a picture of a book trough end table that I have made from your Blueprint No. 3. I also have the blueprint for a Priscilla sewing cabinet, which I expect to make soon. I expect no trouble, as your directions are very clear and simple.

This month's blueprint, No. 39, is illustrated on page 94.

### Complete List of Blueprints

ANY one of the blueprints listed below can be obtained from POPULAR SCIENCE MONTHLY for 25 cents. The Editor will be glad to answer any specific questions relative to tools, material, or equipment.

Blueprint Service Dept.
Popular Science Monthly
250 Fourth Avenue, New York

GENTLEMEN:

Send me the blueprint, or blueprints, I have underlined below, for which I inclose.....cents:

| *No.* | *Title* | *Price* |
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| 1. | Sewing Table | 25c |
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| 6. | Two-Stage Radio Receiving Set | 25c |
| 8. | Shaving Cabinet | 25c |
| 9. | Arbor with Gate and Seats | 25c |
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| 12. | Electric Washing Machine | 25c |
| 13. | Tea Wagon | 25c |
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| 16. | Inlaid Radio Cabinet | 25c |
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| 23. | Pergola Garage | 25c |
| 24. | Gateleg Table | 25c |
| 25. | Sailing Outfit for Canoe | 25c |
| 26. | Baby's Crib and Play Pen | 25c |
| 27. | Kitchen Cabinet Work Table | 25c |
| 28. | Pullman Play Table | 25c |
| 29. | Toy Tea Cart, Garage, etc. | 25c |
| 30. | Tool Cabinet, Bench Hook, etc. | 25c |
| 31. | Priscilla Sewing Cabinets | 25c |
| 32. | Chinese Game Table | 25c |
| 33. | Pullman Dining Alcove | 25c |
| 34. | Trellises for House and Garden | 25c |
| 35. | Simplified Radio Cabinet | 25c |
| 36. | Rush-Bottom Arm-Chair | 25c |
| 37. | Simplified Bookcase | 25c |
| 38. | Sheraton Table | 25c |
| 39. | Salem Chest of Drawers | 25c |

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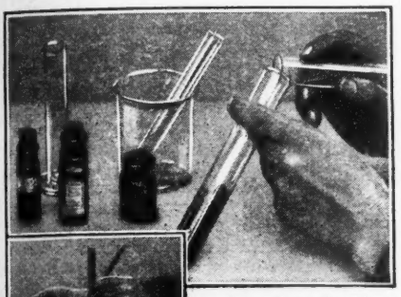
This seal on a radio or tool advertisement signifies the approval of the INSTITUTE OF STANDARDS. See page 33.

## Home Workshop Chemistry

*Simple Formulas that Will Save Time and Money*

OVERHEATED machinery, engine and motor bearings can be detected instantly if they are painted with a preparation of silver mercuric iodide, which is a chemical most sensitive to temperature changes. This paint can be prepared in any home workshop.

At ordinary temperatures silver mercuric iodide is yellow, but it turns dark red when heated to 115° F., a temperature much below the boiling point of water.



Preparing a heat-indicating compound

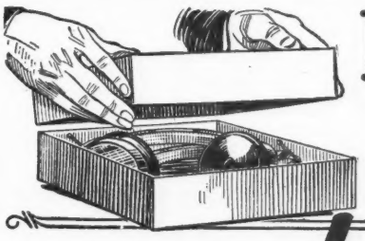
Collecting the yellow precipitate

In order to prepare this chemical, make three solutions. The first consists of 3.3 grams of potassium iodide in 25 cc. of water. The second is made by dissolving 1.3 grams of mercuric chloride in 25 cc. of water. The last is 1.7 grams of silver nitrate in 10 cc. of water.

When all three solutions have been prepared, mix the first and the second and shake thoroughly. Then, and not before, add the last solution and stir. Filter the solution, collect the yellow precipitate, and mix it with a thick gum solution. Paint this on paper or on any sensitive bearing. It will show anyslight increase of temperature by its red color.

Mixing the silver mercuric iodide with a gum solution

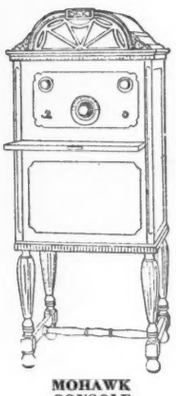
Moisture is abstracted from other substances by heat or, if heat cannot be applied, by means of calcium chloride in a dish placed within a larger box containing the substance to be freed from moisture. This substance avidly takes up all available water, but the calcium chloride, in order to do this, must be in small lumps or granular in form. When the calcium chloride has lost its original shape in the box, it must be replaced by fresh.

# Put Away Your Headphones

Now! You Can Tune Across the Country with Loud Speaker Volume. on Just ONE Dial

Years ahead in perfected, simplified tuning and in loud speaker volume, the sensational new Mohawk is a leader among 5-tube coast to coast radio sets with its true ONE Dial Control. Every good feature of 5-tube power—long recognized as the most efficient—is now improved so that Selective Loud Speaker Distance Reception is now a definite, dependable ONE Dial Control that everyone can operate with ease.



MOHAWK CONSOLE

### *No Need for Headphones*

The new Mohawk is fundamentally and essentially conceived and constructed to be a loud speaker receiver. Without headphones the Mohawk's ONE Dial will tune in stations all across the country direct on the loud speaker for everybody to hear. Even more delightful, the superselectivity of this ONE Dial tuning goes far above the average. It will cut through the nearby stations with unfailing precision and bring in the distant ones loud and clear. Children can do it—elderly people—any member of your family and friends.

Never before has there been this freedom from the difficult task of carefully adjusting several complex controls. And in your home Mohawk beauty of appearance will again increase the pleasure of its wonderful performance with just ONE Dial. Table model, console and consolette are each built in distinctive period type Adam Brown walnut cabinets. The console and consolette have built-in loud speaker, also battery compartments. Every model is broadly, fully guaranteed.

# The Mohawk 5 Tube Receiver

Send the coupon below. Find out the new facts which show the superiority of this 5-tube Mohawk set—and why you can now absolutely depend at all times on long range, beautiful clarity of tone and wonderful volume tuned direct on the loud speaker with just ONE Dial—and all at NO GREATER COST. Mail the coupon NOW.

**Mohawk Electric Corporation**
**2236 Diversey Blvd., Chicago, Ill.**

Mohawk Electric Corporation,
2236 Diversey Blvd.,
Chicago, Ill.

Send descriptive literature on the Mohawk ONE Dial Receiver.

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Please mention your local Radio Dealer's Name.

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Write for your FREE copy of our new catalog today—just your name and address on a postcard will do. Please add the names of any of your friends interested in Radio.

NO other Radio Catalog includes such a complete assortment of the best and latest Knock-Down Kits, Parts, and Accessories. You need this book—write for your FREE copy today!

### *An Unequalled "Kit" Service*

All parts for each "KIT" have been carefully selected and tested by our staff of graduate Radio Engineers — satisfactory results are guaranteed.
Completely drilled and engraved panel included with each "KIT."
Makes set building easy and sure.
No other concern gives this FREE service.
Easy to understand Instruction Book and Blue-Prints included with each Outfit. No technical knowledge required to build your radio set.

*Dealers! Jobbers! Manufacturers!*
ATTENTION!
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## The Home Workshop

### $50 For Unusual Handicraft Photos

IF YOU make a hobby of your home workshop, you may have built at some time or other a piece of furniture, a model, a toy, sporting equipment, scientific apparatus, or some sort of household utility that is out of the ordinary—something that causes your friends to exclaim: "How did you ever manage to make that?" Such an article is the inlaid library table described below.

POPULAR SCIENCE MONTHLY wants photographs of the more uncommon and ingenious handwork of amateur craftsmen. For the best photographs received on or before Feb. 24, a first prize of $25, a second prize of $15, and a third prize of $10 will be given. Other photographs suitable for publication will be purchased at regular rates.

Each contestant should write a brief description to accompany the photograph—not more than 200 words—and tell how he came to make the article. In many instances it may be advisable to submit two photos, one an attractive picture showing the object in use and the other giving a close-up of its construction.

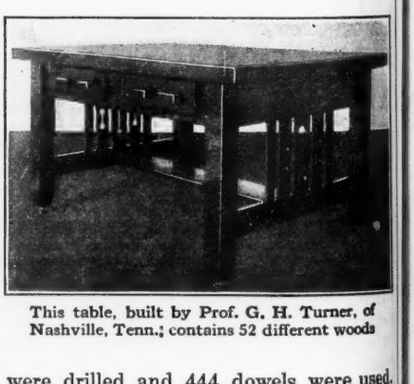
The Board of Editors of POPULAR SCIENCE MONTHLY will act as judges and their decision will be final. Unavailable photographs will be sent back only when accompanied by a self-addressed label bearing return postage. The winners will be announced as soon as possible after the judges complete their task.

### 5022 Pieces of Wood Inlaid in Library Table Top

ONE typical variety of wood from each state in the Union, as well as Alaska, Cuba, Hawaii, and the Philippines, is inlaid in the top of the unique library table illustrated below. It is the work of Gordon H. Turner, Professor of Physics and Chemistry at David Lipscomb College, Nashville, Tenn.

There are 5022 pieces of wood in the top. In fixing them in place, 888 holes were drilled and 444 dowels were used. The framework also is a monument of painstaking intricacy, for 808 holes for dowels, screws, and other fastenings were

(*Continued on page 131*)



This table, built by Prof. G. H. Turner, of Nashville, Tenn.; contains 52 different woods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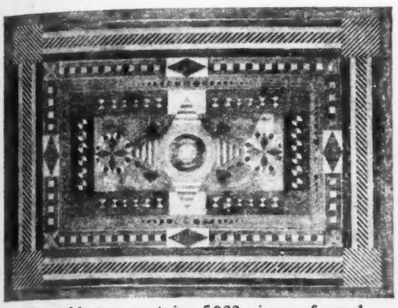
## The Home Workshop

### 5022 Pieces in a Table-Top

(*Continued from page 130*)

drilled or bored, and 148 dowels and 236 screws were used.

The finish on the framework consists of nine coats of varnish and wax; over the inlays are four coats of boiled linseed oil, 12 coats of thin white shellac, six coats of clear oil varnish, and three coats of wax. Rubbing down this record-breaking number of coats was in itself a task extending over weeks.



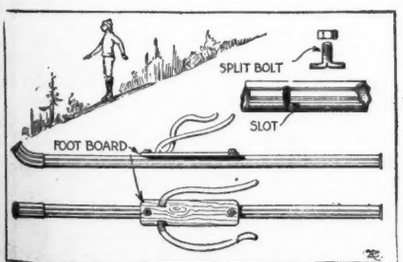
The table-top contains 5022 pieces of wood held together with 444 dowels and glue

While reading poems on trees, Professor Turner got the idea of preserving in a table-top pieces of the most familiar trees of all sections of the country. In the selection and collection of the woods the Forestry Service of the United States Department of Agriculture, as well as state foresters, experiment stations, and conservation stations coöperated.

### Novel Skis Made Cheaply from Rain-Conductor Pipe

DISCARDED galvanized rain-conductor pipe, which can be picked up in almost any second-hand lumber yard, will make a novel pair of skis.

Cut off two pieces 6 ft. long and, just forward of the center, make two slots, as shown, about 15 in. apart. Next, prepare two hardwood foot boards 6 by 18 in. with bolt holes 15 in. apart, as well as two slots 3 in. apart in the front end for tie straps of heavy tape or narrow leather.




The addition of a footboard turns a length of rain-conductor pipe into a practical ski

Through the holes in the foot boards insert T-head bolts made by sawing off the heads of stove bolts, splitting their shanks and bending the split sections outward. Put the heads through the slots in the pipes and turn them at right angles so that they will hold when the nuts are screwed down tightly.

A wide elbow plugged with wood is forced on the front of each pipe.—L. R.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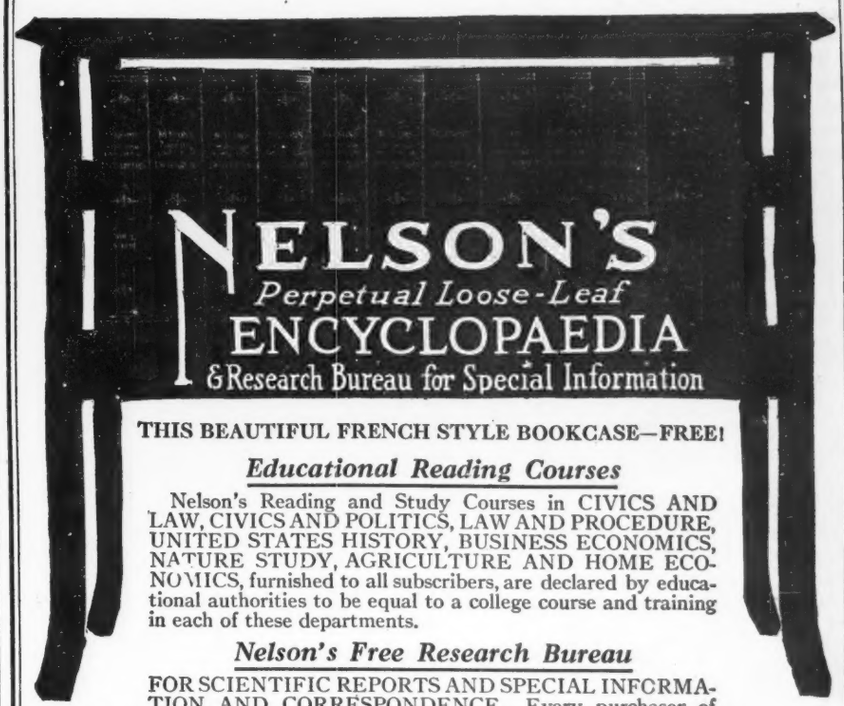


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## The Home Workshop

### Building a Snow Igloo

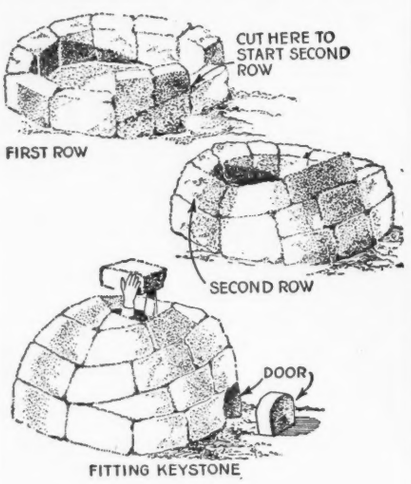
(*Continued from page 93*)

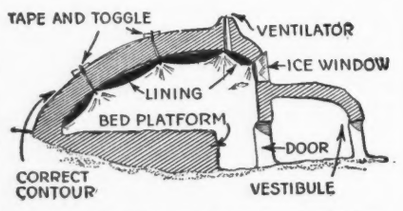
provides support for the near horizontal blocks before the top one, or key block, is in place.

Build slowly. Fit carefully. Do not worry about shape or regularity. No Eskimo builds the same kind of figures on his upper blocks twice in his life. General contour is the important point.

Your key block may be square, oblong, triangular, or even round, depending on how you come out. Drop it gently into place and lower it, if necessary, by the process of running your knife blade back and forth along its edges.

An Eskimo starts his blubber lamp as soon as the igloo is finished. A lamp or an alcohol stove will do. Explorers favor




**Steps in building an igloo and sectional view showing the bed platform and the interior**

a lamp that is really a pressure stove of small size, burning kerosene or gasoline.

The object of heat is to "set" the walls. In five minutes they are seen to settle. If the temperature is around zero, they harden almost immediately. A fine glaze may form inside. This is valuable in shedding moisture or water when cooking begins; it also adds great strength.

During this settling process the rough edges between blocks should be chinked with snow on the outside. A half-round door should be cut and fitted at the bottom in front. Unless a small ventilating hole is made in the roof, the air inside will soon be consumed and the stove go out.

Vestibule, sleeping platform and window are built after about 20 minutes of the settling process. The vestibule is simply a small igloo outside the front door. It provides shelter for dogs and footgear, and makes egress more pleasant. The sleeping platform is built up of hard

(*Continued on page 133*)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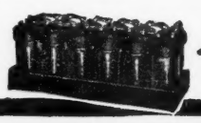

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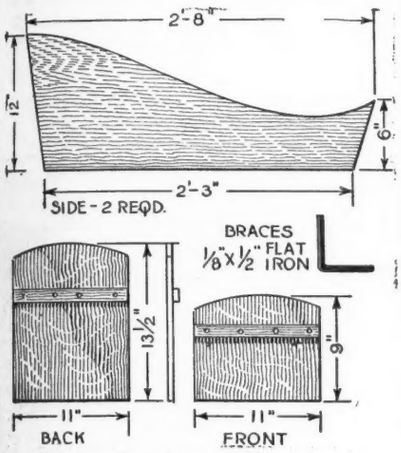
## The Home Workshop

### Quickly Built Box Makes Sled Comfortable for Baby

HOW a child's sled may be made into a useful conveyance for the baby with very little work and almost no expense, is shown in the accompanying illustrations.

A few boards from a dry-goods box can be utilized, or a ½-in. board bought at the lumber yard. If the stock is 12 in. wide, it is possible to cut each of the four parts in a single piece. Otherwise, they must be made in two sections.

A hardwood cleat is fastened to the back and front, and the box put together with screws and fixed to the sled with four small angle braces. Either paint or




Four wooden pieces, two cleats, and four braces are needed for the sled box

varnish may be used in finishing the box.

When the child outgrows this conveyance, the sled is as good as ever for play purposes.

### Building a Snow Igloo

(*Continued from page 132*)

snow blocks, dry grass or skins. It should be above the level of the entrance to assure warmth. The window is a cake of fresh-water ice cut the size and shape of one of the front blocks and pushed in after the walls have hardened.

A canvas or skin lining adds great luxury to an igloo. It should be made the shape of the finished house. Small pieces of tape lead from various points on its surface through the igloo's walls to bone or wooden toggles outside.

The ventilating hole at the top is kept plugged with grass unless the stove flickers or the walls melt too rapidly.

I once lived comfortably through a 24-day blizzard in a snow igloo. Sat and played cards in my undershirt and smoked my pipe. Outside it was 52 below zero and an inferno of wind and drift. Inside was luxury. That's why I think a snow igloo is a man-made miracle.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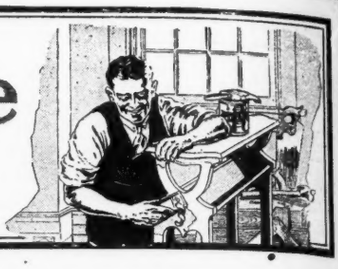
# The Shipshape Home



## *Clothes-Line Reel*

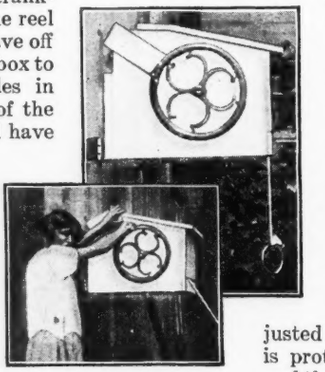
THE task of keeping the yard shipshape in appearance is made easier when a strong, smoothly working, convenient reel is provided for the clothes-line.

To make one, obtain the crankshaft and belt wheel of an old sewing-machine. Build a board drum just by nailing boards firmly together, with the crankshaft between. Build up the reel to ample thickness and shave off the corners. Next, make a box to hold the drum, boring holes in each side to take the ends of the crankshaft. The wheel will have to be detached until the ends of the shaft are in place in the holes. Now put the wheel back on the shaft. The box must be firmly fastened to the side of a building or to a post.

Drill a 5/16-in. hole through the outer rim of the wheel or have a smith do it for you, and put in an iron bolt to serve as a handle. Cut off a piece of "two by four" about 8 in. long. Saw this at an angle of 45 degrees at one end and bolt the piece through the side of the box as shown so that it is at an angle of 45 degrees above the inside upper rim of the wheel. It will form a friction clutch.

Close the front of the box except for a slit ½ in. wide across the entire front. Put a hinged cover on the top of the box. Fasten the end of the clothes-line to the drum with a lagscrew or heavy screweye and wind the line onto the drum. Pull the loose end through the slit and attach a ring.

The drum of the reel illustrated holds from 200 to 300 ft. of rope. The line can be adjusted in about five minutes. It is protected from dirt and wet and the yard looks better.—MISS. A. BESS CLARK, Maquoketa, Ia.

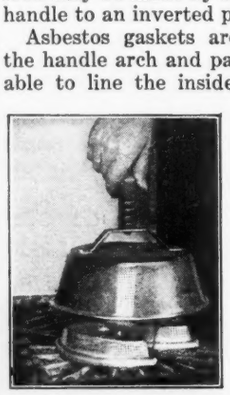


A substantial reel with wooden brake

## *A Heat-Retaining Cover*

A HEAT-RETAINING cover to be placed over flat-irons or dishes containing food may be made by fastening a wooden handle to an inverted pan, as shown.

Asbestos gaskets are placed between the handle arch and pan, and it is advisable to line the inside of the top with asbestos. This may be fastened on by using small rivets and large washers.



For covering irons or a frying-pan

Under this cover flat-irons heat up very rapidly on a gas or oil stove. It also is useful for warming over food in a frying-pan because it keeps the food moist and palatable instead of dry and burnt on one side. —E. W. CORNELL, Adrian, Mich.

METAL tubes in which so many toilet, medicinal, and artists' preparations are sold, sometimes won't unscrew. Light a match and hold the screw-cap over it. After a short time the screw usually will turn.

## *Mending Gas-Hose*

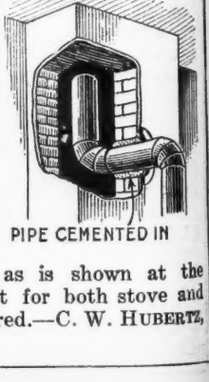
IN AN emergency it is sometimes necessary to repair a leaking gas-hose of the wire-wrapped variety often used on gas-stoves and mangles.

Dip the leaking section of the hose in melted paraffin or candle grease until the coating on the rubber comes level with the wire winding. Then wrap the hose with rubber or friction tape.

As a patched hose never should be used except as an emergency measure, replace it with a new hose as soon as possible. — HERBERT A. MINCHER, Youngstown, Ohio.

## *Improving Furnace Draft*

WHEN a furnace is installed in an old house, it often happens there is a pipe from the kitchen range entering the same chimney. Many furnace men refuse to guarantee a furnace unless the upper flue is closed, for the reason that the furnace will not have sufficient draft. By cementing a small stovepipe and elbow into the chimney for the range connection, as is shown at the right, a good draft for both stove and furnace will be insured.—C. W. HUBERTZ, Corry, Pa.

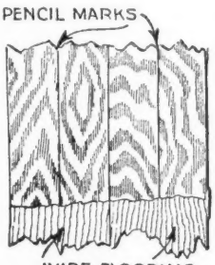


## The Shipshape Home

### *Improving Wide Flooring*

BY USING a lead-pencil and a graining tool, the home worker can imitate narrow hardwood flooring on cheap, wide flooring boards.

After being sandpapered and smoothed, the 4-, 5-, or 6-in. boards are measured and marked off into narrow divisions. Fairly heavy pencil marks are then made down their entire length to imitate narrow joints. Then, when the varnish stain is applied, the wood is grained by using a narrow graining roll in each division separately. This makes a vast difference in appearance.




### *Stucco Ceiling Finish*

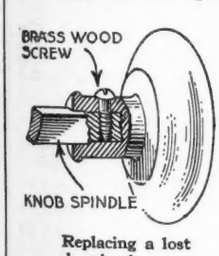
IN DECORATING our dining-room, the stucco ceiling presented a problem that we overcame in a manner others may find useful. The paper for the walls was to be a mottled brown. To suit this a bronze color was used in the ceiling finish, but the color could be varied to suit any toned paper desired.

The ceiling first was brushed over with a hard varnish. This took off some of the loose particles and stuck on all the others, so that after the first coating nothing fell off. This was left to dry overnight and then the whole ceiling was coated with bronze, that is, regular bronze powder mixed with bronzing liquid or "banana oil," which dries very quickly.

To tone down the bright color of the bronze, the next coat was a paint made of equal parts of linseed oil, turpentine and gasoline, with enough Prussian blue to give a light color. More blue then was added to make the color much darker, and the ceiling was stippled, that is, an area about 1 ft. in diameter was painted here and there on the ceiling until a clouded effect was obtained. This gave a beautiful finish and did not destroy the stucco effect, which so many finishes would have done.—H. C.

### *Screw for Door Spindle*

WHEN a door-knob remains loose for some time, the set-screw threads in the square spindle are apt to become so badly worn as to be worthless. Instead of retapping the spindle and fitting a larger machine screw, simply turn a round-headed brass wood screw of suitable size into the old hole. The iron will cut threads in the brass and bind the screw so that it will not work loose. This is a repair always quickly made.




Replacing a lost door-knob screw


# *For Circuit Supremacy—* CIR-KIT *and Supereflex*

Erla Supereflex—new epoch in circuits. Not just a "wave" of popularity, but the permanence of *basically* superior principles, just as advanced today as when Erla introduced the circuits still rated more powerful, tube for tube.

Expressing the best of Erla science, Supereflex circuits also are so easy to own! Not only because of extreme economy in first cost and operation, but also because Erla *CIR-KIT* enables any experimenter to produce these greater circuits flawlessly. *CIR-KIT* provides every needed item of Erla Precision Radio Apparatus—exclusively responsible for extreme Erla range, volume, clarity, sensitiveness and remarkable ease of control.

*CIR-KIT* also provides full-size blueprints; stenciled baseboard; and drilled, lettered panel, so that every step must be correct. Assuring lasting supremacy in circuits; the pride of a truly professional hook-up; and incomparable entertainment, *CIR-KIT* is outstanding in radio today.

**Electrical Research Laboratories**
**Dept. S, 2500 Cottage Grove Ave., CHICAGO**

Ⓢ ERLA

*Erla complete radio instruments lift radio to the realm of art, with the same superiorities CIR-KIT brings.*

*Erla Floor Console* — *Erla Table Cabinet* — *Erla Table Console*

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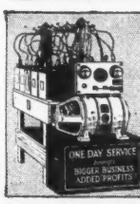
Printers' wages are now so high you can make big money in spare time with one of our printing outfits. No experience necessary. Our instruction book makes everything easy. Presses $12 up. Pay for themselves in a short time. Write today for catalog presses, type, ink, paper, cards etc. THE PRESS CO X33 Meriden, Conn.

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Cut Stones, No Chips
Solid Gold
**$25**
Terms if desired (6 mos. to Pay)

14 kt. White Gold Top. Gold Emblem (any Lodge) or any Initial (Old English) Inlaid in Genuine
**HOPE RUBY**
Also, in Black Onyx
No. 6132
Send size of finger and ring will be sent for inspection.
This ⓧ Reg. Trade Mark guarantees you genuine diamonds.
Send for Free Catalog D J C M S W Any Letter
Buffalo Jewelry Mfg. Co., "The Mail Order House" Dept. A Brisbane Bldg. Buffalo, N. Y.


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Rounded END fits your hand
2 FILES IN 1 Coarse-cut on one side; fine cut on other
Length 10 INCHES (Picture is only 3/5 actual size)
The name PLUMB insures long, faithful service
Forged HANDLE is part of file. Gives control to stroke
Metal-bound SHEATH comes with every file to protect teeth
PLUMB U.S.A.

**Right now you need a Plumb All-Work* File**

(*Trade Mark Reg. U. S. Pat. Off.)

For sharpening tools, knives, etc.; for radio work; for filing steel, iron, copper, fibre, hard rubber, wood, etc., get a Plumb All-Work File.

Files anything, sharpens everything. Two files and a handle, all in one, with sheath to protect teeth.

35¢ At your dealer's or by mail. (40c West of Rocky Mts.)

Get it at any hardware store where good mechanics trade.

If your dealer has none in stock, send the cost to us (stamps will do) and a Plumb All-Work File will come to you by the next mail.

Carry it in your pocket, your tool kit, or car. You'll wonder how you ever did without it.

FAYETTE R. PLUMB, Inc.
4814 James Street Philadelphia

# Better Shop Methods

## What You Can Do with the Aid of a Portable Electric Drill

By George Arthur Luers

*Mechanical and Automotive Engineer*

THE foundry was about to pour a 10-ton casting. The furnace was up to heat with 14 tons of molten steel. The mold was complete to the final detail. Two weeks of exacting preparatory work had made all ready for the pour.

As a last precaution, the molder tried out the release before filling the crucible. He was dismayed to find a broken connection.

After a tense and anxious scrutiny of the break, the master molder gave a few quiet orders. A machinist brought in a portable electric drill, some drills, and several bolts.

In critical emergencies, as when this crucible connection broke, an electric hand drill often can be used to save the day

Ten minutes' work by the mechanic and his helper with the drill and they were able to put bolts through to hold the connection. The foundry work then proceeded to a successful pouring of the huge casting.

Not only does the portable hand electric drill come to the aid in breathless emergencies like this in a big foundry, but the usefulness of the tool follows through to the final installation of the identification plate on the finished construction.

The hand drill of the electric type, with grips, convenient switch and adjustable chuck, is a comparatively late utility. It really has come into almost universal application and been appreciated thoroughly during the past 10 years. Its moderate cost, convenience, and serviceability are responsible for its popularity.

The tool is especially convenient because it obtains its power from any electric-light socket.

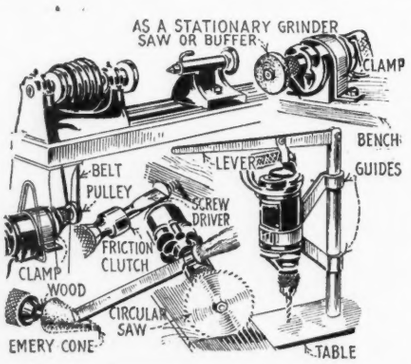
The light weight and portability adapt it to manual use in practically every location, no matter how inaccessible. Jobs ranging from factory production to the household task of sharpening the carving knife, find the portable electric drill an indispensable time- and labor-saving tool. To describe the applications of an electric drill at length would be impossible in this article, but a brief outline of the valuable work that can be accomplished by it in several different fields will suggest what you can do in your own line with a good drill.

**In the Machine Shop**—Grinding, particularly tools that are in place on boring bars; tool clearances in work on machines, on lathe tools, and in work being assembled.

Scratch brushing and buffing to remove forging or casting scale and in assembly work, before enameling or polishing the finished product.

Drilling holes at assembly for bolts, rivets, screws, and for attaching name plates. Countersinking and reaming during assembly.

Screwing on nuts is another use for the drill, when special fittings are available. These fittings are some simple form of friction clutch, made up as a plate clutch, which will release the drill from the work when the bolt seats or the tool jams. A clutch also is required in many instances for tapping or reaming, where it is not practical to govern the tool movement closely enough by the switch alone.




Using an electric drill to drive a lathe, a saw and a screwdriver, and for other purposes

A variety of other work in which a revolving tool is used, can be accomplished almost as easily as drilling.

**In Carpentry and Pattern Shops**—Boring with the bits intended for the brace is an achievement in which the portable drill vastly exceeds all the speed of hand work.

Dowel holes, door-latch mortises, tumbler-lock recesses, and almost every form of circular opening can be made with the electric drill without physical effort.

Tool sharpening, by means of a small

(*Continued on page 137*)

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## Better Shop Methods

### A Portable Electric Drill

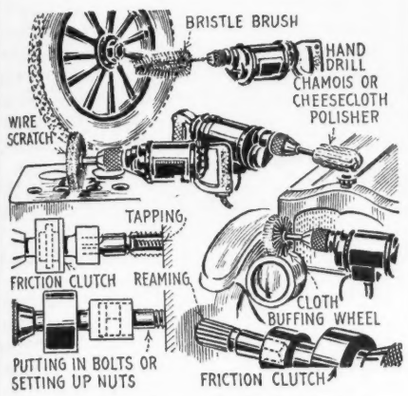
(*Continued from page 136*)

emery or carborundum stone mounted on the drill, is most expeditious. The sharpening of circular saws, blades of trimmers, planer blades, router blades, and various other machine tools can be taken care of, frequently by grinding them in place.

Grinding gouges of the inside ground type, is done readily by using an emery cone held in the drill chuck.

Driving screws can be accomplished with great speed and ease with the portable drill. A disk clutch that will release when the screw "bottoms" is required in this application.

Sawing, such as is necessary to cut through centers of flooring or walls, can be done with a small circular saw chucked in the drill. Electric outlets, water piping, and heating-pipe installations require the use of the keyhole saw, but the small circular saw on the drill dispenses with much laborious keyhole saw work.




**In auto maintenance work, the electric drill has many uses other than drilling**

Many other applications of the drill in pattern work are possible by making simple revolving tools to replace edge cutters. By use of a pulley, the drill can be made to drive a foot-power turning lathe. The writer has seen the drill adapted by use of a crank attachment for driving the sand riddle in a foundry.

**In the Building Trades** — Drilling through girders, joists, and beams makes the portable drill an invaluable aid to the builder. Many operations in plumbing, electric work, heating-plant work, gasline installations and roof work can be done faster with its aid.

Scratch brush work, in which a wire brush is mounted in the drill, makes possible a much desired finish for face brick on the building front. With smaller brushes the routing of mortar from face brick can be accomplished with ease and rapidity.

Emery and sandpaper disks mounted in the drill are used to advantage in finishing inside trim.

A circular saw on the drill finds a multiplicity of uses in the building, from hanging window sashes to cutting special moldings for trimming out.

An emery wheel on the drill allows edge tools, from the chisel to the hatchet, to be

(*Continued on page 138*)

$65

PARAGON FOUR

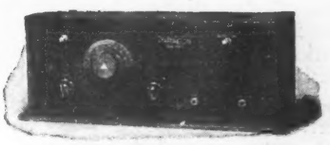
*Easy to Tune— Easy to Own!*

THE new Paragon line of Radio Receivers is making radio history for fans of all ages and purses—the new Paragon Four, especially.

A four-tube set that is getting everything that's in the air. Getting it clear and strong on the speaker. And tuning in sharply and distinctly at a twist of the single tuning dial.

As fine a set as Paragon ever made—doing all that you expect of far costlier sets that use more tubes—yet costing only $65. No greater value in radio today!

Write for "Station Please!", a folder picturing and describing the new set in detail.



New Paragon Four, $65

Four tubes. Handsome mahogany case 21 inches long. New Paradyne *non-radiating* circuit. Almost unlimited range for clear, strong speaker reception.

New Paragon Three, $48.50

Three tubes. Mahogany case 17 inches long. Clear speaker reception over range that amazes you.

New Paragon Two, $27.50

Two tubes. Mahogany finish case, 11 inches long. Excellent speaker tone and volume from local stations. Almost unlimited phone range.

ADAMS MORGAN CO., Inc., 2 Alvin Ave., Upper Montclair, N. J.

*Originators since 1915 of Record-holding Radio Receivers*

$25.00 in PRIZES See top page 10 in front of book for details

The Saw Sold on Money-Back Guarantee

Backed by a guarantee of satisfaction we have built the largest business in small bench machines in the World.

BOICE-CRANE JUNIOR SAW

This sturdy precision built machine will saw, sand, miter, rabbet, tenon, and many other operations with ease and accuracy. Saws 1¼" stock. Driven by ¼ or ⅓ h. p. motor attached to any light socket.

*Write for Descriptive Catalog on Bench Machines, Jointers and Band Saws.*

W. B. & J. E. BOICE
Dept. P.S. 2 A, Toledo, Ohio
*"Largest Makers of Small Bench Machines in the World"*

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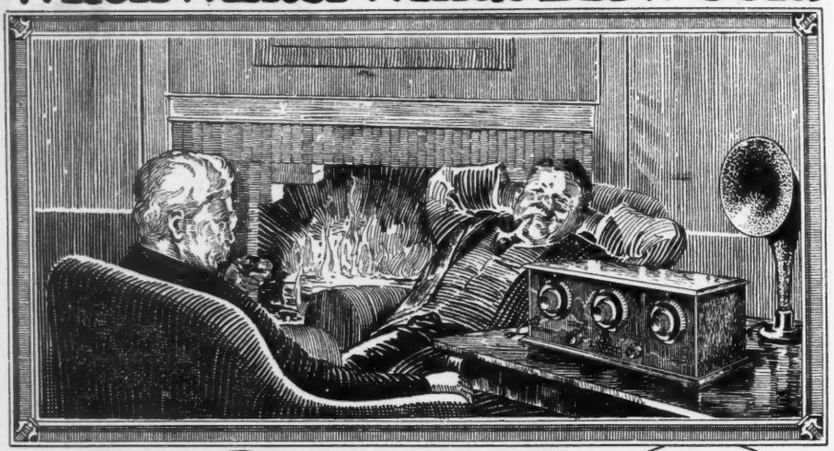
# When Winter Winds Blow Cold



# FRESHMAN MASTERPIECE

*Users Claim It Is the Greatest Value Ever Offered in a Radio Receiving Set!*

**A 5-tube Tuned Radio Frequency Set**

made of the finest low loss materials and in a beautiful genuine solid mahogany cabinet, that is attractive enough for the most pretentious room, and at sixty dollars, economical enough for the most modest.

Combines all points essential to the perfect receiver. Real distance reception without that squealing and howling. So selective that once a station is picked up—it can be brought in again on the same points on the dials, whenever you want it. And, what's more,

$60

**Tuned Radio Frequency Kit**

$17.50

**It's Easy to Build**

a five tube radio frequency receiver when you use the Freshman Masterpiece Kit. The result will be a receiver that will bring in even the most distant stations with the volume and clarity of locals. The equal of any 5 tube set in selectivity, simplicity of operation and all around efficiency.

*No Neutralizing or Balancing Condensers Required*

**IT IS MIGHTY EASY TO OPERATE** Ⓢ

*Have Your Dealer Install One in Your Home!*

All genuine Freshman Masterpiece Sets have a serial number and trade-mark riveted on the sub-panel. The Receiver is not guaranteed if number has been removed or tampered with.

**CHAS. FRESHMAN CO., Inc.** FRESHMAN BUILDING 240-248 W. 40th St., New York

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containing **Suggestions to Inventors** as to Inventions Needed. We invite manufacturers to address us regarding inventions they want.

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**BLANK CARTRIDGE PISTOL**

*Protection against Burglars, Tramps, & Dogs*

PRICES 50c. $1.00 POST-PAID

Well made and effective; modelled on latest type of Revolver; appearance alone is enough to scare a burglar. When loaded it may be as effective as a real revolver without danger to life. It takes standard .22 Cal. Blank Cartridges obtainable everywhere. Price 50c. Superior quality $1.00 Postpaid. Blank Cartridges, by express, 50c per 100.

**Johnson Smith & Co., Dept. 288, Racine, Wis.**

**RADIO SETS** $4.95 and up Book FREE

Containing a full line of complete outfits and parts at exceptionally low prices.
*Write immediately to*

**UNITED RADIO SUPPLY CO.**
1346 S. Michigan Ave., Dept. R.S. 2 Chicago, Ill.

*Makes breathing easier*

Luden's Menthol Formula soothes and relieves your nose and throat.

**LUDEN'S** Menthol COUGH DROPS


## Better Shop Methods

### A Portable Electric Drill

(*Continued from page 137*)

kept in condition on the spot without loss of time.

**In the Tinsmith and Forge Shop**—Drilling and cutting out circular disks in thin sheet metal is one useful job that can be accomplished by the drill in the sheet-metal shop.

Tool sharpening is done as in previous instances, with an emery wheel mounted in the drill.

The scratch brush and polishing wheel are nearly indispensable, and the sheet-metal worker will find the portable to have advantages not met with in the fixed grinding head. The scratch brush makes possible clean and perfectly soldered joints.

The countersinking of forged parts and drilling for rivets can be done in the forge shop many times faster than with the older type of hand drill.

The portable has a variety of uses in the tin shop and forge shop that extend from grinding the shear blades to resurfacing the face of the anvil. Many special uses require only special chuck fittings. In fact, in an emergency it will do numerous odd jobs, from stirring the mixing vat to driving a ventilating fan.

**In Private and Public Garages**—In the repair and maintenance of automobiles, the hand electric drill comes in for a variety of work that perhaps is not exceeded by any other tool.

Hole drilling with the portable expedites the application of riveted patches to the body and fenders. Special fittings for the dash, luggage carriers, speedometers, electric wiring and lights are all installed with the aid of a portable.

Wire scratch brushes, driven by the drill, are used to rasp and buff the rubber on tubes and tires for repairing in some of the large service stations.

Reboring cylinders and honing cylinders is work for which special tool equipment, using the power of the drill, is marketed by several manufacturers.

Nut drivers, screwdrivers, and valve grinders are also being made by manufacturers for use with the portable.

Carbon removal with the wire scratch brush in the portable is an improvement over scraper methods. The wire brush removes every vestige of carbon, even from recesses in the cylinder head, as well as the deposits around the valve ports.

Canvas buffing wheels, dry or with applications of rouge or crocus, are used to clean up the brass, nickeled and aluminum parts of the car. Very soft wheels, about 6 in. in diameter, should be used on the nickeled parts.

Wheel cleaning is done expeditiously by mounting a round bristle brush in the portable chuck.

A polishing brush can be made from chamois or cheese-cloth, mounted in a wooden holder and secured in the portable chuck, for use in polishing the waxed surface of the car.

These are only a few of the uses. The portable is an invaluable aid in every detail of work from drilling for a cotter pin to plugging up a cracked cylinder head.

(*Continued on page 139*)

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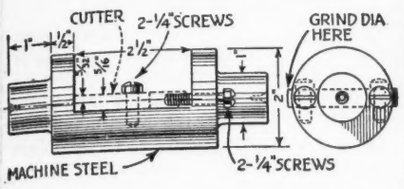
## Better Shop Methods

### Cutter Grinding Arbor




THIS arbor is designed for grinding the outside diameter on removable drill and reamer cutters. The cutter is held on the arbor with two fillister-head screws in the same position in relation to the center as it is when in place in the drill or reamer body.

### A Portable Electric Drill

*(Continued from page 138)*

**In the Home Workshop**—In the home workshop, the portable drill finds an unlimited field of usefulness. Repairs of every nature, from the furnace to the installation of complete window and door screening, are accomplished neatly and rapidly with a handy portable.

A practical application of the drill is as a small power plant to turn the home-workshop lathe. A pulley and clamp connect the portable with a belt drive to the lathe headstock spindle.

The scratch brush, grinding wheel, and buffing wheel are always useful attachments to the home-workshop drill. Tool grinding, metal polishing, removal of old paint and enamel are done with these attachments.

The buffing wheel is of service for many jobs, from refinishing a chandelier to refinishing a brass bed.

With the addition of a small circular saw and a guide plate around the saw, the portable may be converted to wood cutting.

Many constructions are possible that will utilize the power of the drill. These are along similar lines to corresponding shop machines. Surface grinders, small milling attachments, stationary drilling machines, and holders for the portable drill can be made from iron plate, angle iron, and other easily handled materials, including wood.

**Care of the Electric Drill**—The drill requires care. It should never be water soaked and shorted. It is advisable to keep it in a box on a shop shelf, shielded from dust and dampness. The electric cable connection should be given an occasional coating of shellac varnish. The cable should not be kinked unnecessarily, or pulled or rubbed. The commutator and brushes should be cleaned occasionally with fine sandpaper.

Oil the bearings with the regularity prescribed by the maker. It is not necessary to take the machine apart frequently, but all the screws and bolts in the frame should be kept intact and tight.

The electric drill represents the modern trend in tool design. It is no wonder it increases in popularity every day, because it has an unlimited capacity to save time and labor.


# 60 MILES ON A GALLON OF GASOLINE

## TESTS SHOW FORD CAN RUN 60 MILES ON A GALLON

The amazing fact that a Ford can run 60 miles on 1 gallon of gasoline was recently brought to light through tests conducted by America's foremost engineers, where it was shown that a gallon of gasoline contains sufficient heat units which if properly atomized and mixed with air would give this additional mileage. Great strides have already been made in this direction by the recent invention of a simple attachment which can be installed in a few minutes without any alterations to the motor. It is common for Ford Owners to make from 40 to 44 miles per gallon after this marvelous device is attached.

## MOST WONDERFUL INVENTION TODAY BRINGS JOY TO FORD OWNERS

**Starts Ford Instantly**

Starting a Ford Car in cold or zero weather is something every Ford Owner dreads—everybody realizes that difficult starting is an abuse on the starter and battery. Thousands of Ford Cars are "laid up" during the Winter just for these reasons. This great difficulty has been overcome. "The SUPER positively starts a Ford Car instantly in the coldest weather."

**Eliminates Oil Pumping in Front Cylinder**

What a wonderful relief to Mr. Ford Owner when he realizes that he can run his car without the motor pumping oil in the front cylinder. Sounds like an awful lot to expect of any device, but that is what the SUPER does and this is only one of its many advantages because it puts real efficiency into any Ford Car.

**Marvelous Device**

The SUPER is no trick affair—requires no mechanical adjustments and contains all the scientific principles of carburetors costing $20 to $35 and in its natural action uses up every particle of unused gasoline and breaks it up into a perfect vapor. The hitherto impossible is now realized by the SUPER.

*The Heart of the Motor*

**Complete Combustion**

The SUPER is so designed that it takes advantage of the present Ford Carburetor and properly atomizes the light as well as the heavy elements of the fuel, converting every atom of gasoline and kerosene into power preventing liquid fuel from passing into the cylinders, thus avoiding carbon formation and oil dilution.

**Everybody Satisfied**

**Saves 3 to 7 Dollars Per Month**

The best investment I ever made. The SUPER is saving me from three to seven dollars each month. besides putting new life into my motor. A. H. WORRA, Iowa.

**Makes 44 Miles Per Gallon**

I have tried the SUPER and the results of the experiment are satisfactory. One quart of gasoline run my Ford 11 miles over improved roads which is just about again as far as I could run with the plain Ford Carburetor. G. E. YODER, Penn.

**Easy to Sell**

**Sells Like Hot Cakes**

This is a recent letter from one of our distributors: "Enclosed find draft for 200 more SUPERS, rush as I need them badly. I sold and banked $104.00 in one day. Hope to sell 1000 SUPERS next month." A. W. LEONARD, Penn.

**Making Big Profits Every Noon**

I have been working the SUPER at noon only. Yesterday noon I made more money with the SUPER than I did at my 11 hours' hard work in the factory all day. J. L. LEHNER, Wis.

**Finds That Our Claims Are Correct**

I find that your claims for increased mileage are correct and that a big saving is made by your SUPER, in fact, the best device I have met with in that line. M. J. VAN LEEUWEN, Mass.

**Had No Previous Selling Experience**

This letter shows what ambition does: "I sold six SUPERS in less than 2 hours tonight. I think it's a pretty good start—for it's the first thing I ever sold." E. MANGOLD, Ind.

## $60.00 TO $150.00 PER WEEK EASY

You just can't help making Big Money selling the SUPER because a trial sells itself and soon every one in the neighborhood get talking about this marvelous device. Men like Leonard, Shaw, Manner, Kinsley, Peters, Sands, Beck and Hall are not exceptional salesmen but just the type of men that saw an opportunity and were quick to grasp it when within reach. No previous selling experience is necessary, just a little ambition on your part to make money is all we ask and we will extend the same opportunity to you. Spare time will pay you well. If you can devote your entire time so much the better, because the SUPER is a whirl-wind seller and takes hold in a locality like wildfire.

**Men Wanted Everywhere To Introduce**

We want distributors in all parts of the country to take orders and deliver the SUPER and to look after the repeat business that is bound to follow and to such distributors we are willing to assign territory. You do not have to own a Ford to take up this proposition but if you have a Ford it is easier to explain its many advantages. However a Trial of the SUPER convinces the most doubtful person and tells a wonderful story.

**A REAL FUTURE HERE**

**WEEKS SUPER CARBURETOR CO., 1304-750 Fond Du Lac Avenue, MILWAUKEE, WIS.**

**MAIL TODAY**

WEEKS SUPER CARBURETOR CO.
1304-750 Fond Du Lac Ave., Milwaukee, Wis.
Gentlemen: Please mail me full free particulars about your wonderful invention.
Name.....
St. or R. F. D.....
Town.....
County.....
State.....

Ⓘ **HONEYCOMB COILS**

The Universal all-wave inductance. Back and front panel mountings. Send 25c for Super Het., R. F. and Honeycomb Coil Circuits and Complete Catalog.

Chas. A. Branston, Inc.
Dept. 9,
815 Main St. Buffalo, N. Y.

**BURN YOUR NAME ON TOOLS WITH ARKOGRAF**

Protect your tools from theft. Write any name, engrave any design on tools and metal with electricity like writing on paper with pen or pencil. Complete outfit $3.50, prepaid anywhere. Interesting descriptive circulars free. Write to-day. Agents wanted.

Arkograf Pen Co., 1171-A East Stark St., Portland, Oregon

**$7.65 IN 4 HOURS SPARE TIME**

Hampton made $7.65 in four hours spare time just wearing this Beautiful Hand-Tailored Cap, made to his Individual Measure, and you can do the same—you can easily earn $50—$75 a week in your spare time.

**Get This Cap FREE**

I want to give you this cap FREE—I know your friends will be delighted with its Class, Style and Fit and you will make a generous profit taking their orders. Choice of 5 styles and 25 fine fabrics. Send your name right away and I'll tell you how to make $50 a week in your spare time. Write me at once. J. W. Taylor, Pres., Taylor Cap Manufacturers, Dept. 9-B Cincinnati, O.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## Each Instrument of the Orchestra in PERFECT TUNE

IT makes all the difference in the world with the enjoyment you get out of radio whether the high notes of voice and orchestra are in tune or just a little "off."

A big point of the Bristol Audiophone is that each instrument, and each vocal note, comes in in proper pitch. You will love your Audiophone for its pure harmony of reception.

There are four Bristol Audiophones, priced from $12.50 to $25.00, and a cabinet model at $30.00. If not at your dealer's, write for Bulletins Nos. 3011, 3017, and 3022-CA.

**Model S**
**$25.00**

Solid rubber horn 14½" in diameter. Cast metal throat. Mottled bronze and gold on a velvet mat finish.

**The Bristol Company Waterbury, Conn.**

BRISTOL AUDIOPHONE LOUD SPEAKER


## Better Shop Methods

### Success in Grinding

(*Continued from page 98*)

test, and much valuable data are compiled for the information and guidance of the men who use their product. They are always ready and willing to help solve any of your grinding problems.

Never condemn a wheel because it does not produce the desired results, before making sure that you are using the right wheel. Many times a man complains about a wheel when a change of grade would have turned the trick.

Grinding wheels may be divided roughly into two classes or grades—hard and soft. These two grades, however, are subdivided into many degrees of hardness and softness. The grade of the wheel refers also to the strength of the bond that holds the grit in place.

The hardness or softness of a wheel should not be confused with the hardness or softness of the grit. If a wheel is soft, it will wear away rapidly under working conditions, or the grit can be cut away very easily with a diamond when truing up the wheel. A hard wheel is not affected so easily.

The cutting efficiency of a wheel depends upon the fineness or coarseness of the grit. The grit or grain is known by a number, which signifies the size of the abrasive particles that will pass through a screen of a given number of meshes to the inch. In other words, a 40-grain wheel means that the grit of the wheel will pass through a screen having 40 meshes to the inch.

TO SELECT the right wheel for a given job, you must consider the kind of metal to be ground, whether it is hard or soft; the size of the job, how much metal is to be removed, and the finish desired. If the wheel should be too soft, the bond will be too weak to resist the cutting action for any length of time and it will wear away before the abrasive has had time to do its work. On the other hand, if it should be too hard, the bond will hold the grit long after it has done its work, the wheel will clog up and become glazed, and it will not cut. Continued use in this condition will cause burning of the work or excessive heat. Hard materials require soft wheels and soft materials require hard wheels.

One other factor governs the action of a wheel, that is, the size or diameter of the work. The area of contact between the wheel and the work is increased as the diameter of the work increases. This applies to both internal and external grinding. The larger this area becomes, the softer should be the wheel.

The right combination is often found by testing different wheels of varying degrees until one is found that gives best results. This is practicable on production work, but on tool and experimental work it is not so often possible to get just the right wheel for the job.

The next important consideration for best results is the speed of the wheel. First in this connection is the matter of safety. All modern grinding wheels are designed and built to run at a certain

(*Continued on page 141*)

## *Don't Blame Your Set!*

If the batteries run down, you're lucky to get anything but "sounds."

APCO Battery Charger keeps radio batteries *alive*. Works noiselessly, efficiently, surely, fully charging any radio battery over-night for a few cents. 7½ ampere capacity. Pays for itself in six months. Guaranteed one year.

***Write for circular and dealer's name***

**APCO MFG. CO.**
**Baker Street, Providence, R. I.**

**APCO BATTERY CHARGERS** Ⓢ
***for "A" and "B" Batteries***

## FAHLBERG
**MADISON, WIS.**

***For Perfect Conductivity in Radio*** It is now possible for the amateur to get tight, clean joints in his home soldering that make the perfect conductive path necessary in radio work. Mr. E. D. Fahlberg, former Professor of Metallography at Wisconsin University and Metallurgical Engineer with Western Electric Co., has developed Reddy Hot, the complete home soldering furnace. Heats iron in *two minutes — non-explosive — Burns denatured alcohol.*

## *Reddy HOT*
***Soldering Furnace and Tested Supplies***

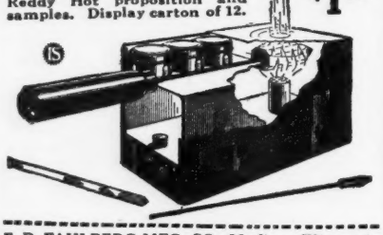
Reddy Hot Soldering Outfit consists of: Large soldering copper, detachable handle—Fine soldering copper—Reddy Flo Household Solder—Can Reddy Stik non-corrosive Soldering Flux for Radio—Can Reddy Prest Sal Ammoniac, keeps tip clean—Can Reddy Rub Abrasive Tape. Complete directions. Ask your dealer. If not obtainable we will send direct, for a short time only, on receipt of price.

**E. D. Fahlberg Mfg. Co., Madison, Wisconsin**

**JOBBERS AND DEALERS: Write or wire for attractive Reddy Hot proposition and samples. Display carton of 12.**

**PRICE, $1.50**

Ⓢ



**E. D. FAHLBERG MFG. CO., Madison, Wisconsin**
Send me prepaid one Reddy Hot Soldering Furnace for which I enclose $1.50. P. S. M.

My dealer's name is.....

Signed: Name.....

Address.....

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## Better Shop Methods

### Success in Grinding

(Continued from page 140)

speed, both with the idea of safety and highest cutting efficiency. The wheels are tested before leaving the factory and the safe speed is marked on the label accompanying the wheel. This speed never should be exceeded.

It often happens that the label is lost or mutilated and this important information is not readily at hand. Roughly, a surface speed of one mile a minute for any kind of a grinding wheel is a fairly safe rule to follow when in doubt, and this is not far from the actual speed specified for any wheel. The makers generally advise a speed ranging between 5000 and 6000 ft. a minute. Never exceed 6500 ft. a minute without special instructions.

GREAT care should be taken in mounting a grinding wheel on the machine spindle. It never should be forced on, but must be a free sliding fit.

If the wheel is too tight, scrape out the lead inner lining to make it go on freely. A pad or washer of heavy cardboard, rubber or felt must be used on each side of the wheel between the flanges. The nut is never to be set with excessive pressure, as there is danger of starting a crack that will weaken the wheel. It is good practice and a safety precaution to examine a wheel before placing it on the spindle, to see that there are no hidden defects that might cause it to break.

In all grinding operations it is important to have the wheel running true. The best results are obtained by truing up the wheel often. On some kinds of work this may mean truing up after each piece. On production work of a light character, perhaps a dozen or more pieces can be ground before it is necessary to true up the wheel.

If the machine is running steadily all day on one kind of work, it is good practice to true up the wheel about every 30 or 40 minutes. This insures against clogging and keeps the wheel always sharp so that it will do its best work. A diamond should be used for truing.

IN COMMON practice, grinding is classified as "wet" and "dry." Production grinding is usually carried on by the wet grinder. Wet grinding requires a lubricant, either plain water or any one of many grinding compounds. These compounds are usually some soapy substance mixed with water.

A grinding compound is best for all practical purposes; it eliminates the tendency of the work to rust and gives a much better finish. In Figs. 1 and 4 (page 98) is illustrated work done by the wet grinding process. Figure 1 shows a machine set up for grinding crankshafts and a close-up of the job.

Grinding crankshafts is a job that has become highly specialized. It is now commonly done by what is known as the wide-wheel method. In many cases the machine is specially designed and there is no lateral movement of the wheel. The wheel is fed directly into the work

(Continued on page 142)


# MAGNAVOX Radio

## Receiving Set TRF-5 with Reproducer M4 - $125.00

MAGNAVOX Reg U.S. Pat. Off.

EXPERIENCED radio users have stated that this Magnavox equipment (illustrated below) represents the highest standard of real value and usefulness ever offered in the radio field.

The Magnavox 5-tube circuit is a special development of tuned radio frequency in which a splendid balance of selectivity, range and volume have been attained. The one dial Station Selector eliminates all tuning adjustments; while the Magnavox Reproducer insures sonorous, pleasing tone for all programs.

*Magnavox Radio Receiving Sets, Tubes and Reproducers are carried by reliable dealers. Illustrated booklet on request.*

THE MAGNAVOX COMPANY
OAKLAND, CALIFORNIA

*New York:* 350 West 31st Street
*Chicago:* 162 N. State Street
*San Francisco:* 274 Brannan Street

*Canadian Distributors:* Perkins Electric Limited
Toronto, Montreal, Winnipeg

2R

NEW VEST POCKET
ADDING MACHINE

Adds as rapidly and accurately as a $300 machine, yet fits the vest pocket. Mechanically perfect. Easy to operate—nothing to get out of order. Everyone who uses figures should own one. $2.95

Counts Up to 999,999,999

Total visible at all times. A pull of the finger clears it. Don't carry a pocket full of pencil stubs and scrap paper to do your figuring. Carry a Ve-Po-Ad.

**10 Days Trial** Send no money. Just name and address and we will send machine postpaid. Pay postman on delivery $2.95. Use it for 10 days to prove it does all we claim. If not perfectly satisfied we will refund your money. Limited supply. Send order today.

Reliable Adding Mach. Corp., Dpt. 73
170 W. Washington St., Chicago, Ill.

AGENTS Here's a money maker. Everybody wants one. Splendid profit. Write for special offer.

**Easy to Draw Cartoons**

**When Shown in the RIGHT WAY**

Some of the cleverest cartoonists and comic artists learned how to draw in their spare time by following **Cartoonist Evans' Simple and Easy to Learn Method** and are now MAKING GOOD MONEY. Send one of your drawings, and let Mr. Evans see if you have ability and receive the **Portfolio of Cartoons** and full details about the course. **It is not expensive.**

**THE W. L. EVANS SCHOOL OF CARTOONING**
825 Leader Building Cleveland, Ohio

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# RECEPTRAD

GREIFF DOUBLE SELECTOR

## MULTIFLEX KIT

*The Perfect Four Tube Circuit-Loop Operating*

This wonderful circuit uses four tubes and has two stages of radio frequency, a crystal detector and three stages of audio frequency. Developed by the Research Engineers of the Radio Receptor Company, working under the direction of Lieut. Greiff, of Super Heterodyne fame. The tone quality is really captivating. No station too far away to be brought in consistently. It can be assembled by any one in a few hours. For simplicity and ease of tuning, as well as power and quality of reception, it is far superior to a 5-Tube Neutrodyne.

**$29.50** Containing principal parts — **$50.00** Including all parts

**FREE**—*Complete literature that's educating as well as interesting. Just ask your dealer or write direct for assortment No. 2, containing blue prints of wiring diagram of circuit. Just drop us a line giving your dealer's name and address.*

RECEPTRAD PRODUCTS

**RADIO RECEPTOR CO.** IS

59 Bank Street New York City

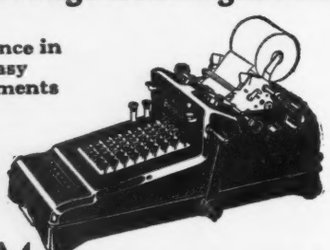


# Only $10 Down

Buys This

## Fully Guaranteed BurroughsAddingMachine

Balance in easy Payments



This is a standard Burroughs Machine used in banks, offices and stores everywhere. It has been completely overhauled and worn parts replaced. It is guaranteed for the same period as a new machine.

Take advantage of this remarkable offer today—pay only $10 down and let the machine pay its way in your business. Total cash price only $100.

*Other styles and sizes in leading makes of figuring machines.*

***Mail This Today***

**General Adding Machine Exchange**
**6809 Second Blvd., Detroit, Michigan**

Please send me information about this special guaranteed Burroughs Adding Machine.

Name_____

Business_____

Address_____



Licensed by Independent Radio Manufacturers, Inc.

Reg. U.S. Pat. Off. **NEUTRODYNE** Reg. U.S. Pat. Off.

Patented March 27, 1923, Hazeltine Patent No. 1450080 Other Patents Pending

## Howard 5-Tube Neutrodynes in Chicago Successfully Brought in European Stations on Recent Trans-Atlantic Tests. If Your Dealer Cannot Demonstrate Them to You, Write for Information, Giving Dealer's Name.

GUARANTEED **Howard** PRODUCTS Chicago, U.S.A.

Mfg. Co. Inc. IS


## Better Shop Methods

### Success in Grinding

(*Continued from page 141*)

with the hand-feed screw. Stops are set for the size of the pin and the diameter is checked with a dial test indicator attached to the machine. The wheel, of course, corresponds to the length of the pin and is made especially for each size of crankshaft being ground.

A GREAT variety of work can be done by the wide-wheel method, and now machines have been perfected that produce finished parts much more rapidly than the old center-traverse methods. The most recent development in this line is the centerless grinder shown in Fig. 2. This method is a radical departure from all previous practice. The operation of the machine is continuous. The work, being fed into the machine, passes between two wheels, which are set in relation to each other to produce a grinding and feeding action, as shown diagrammatically in Fig. 5. The work is supported by a rest, and the grinding wheel presses the work against the rest and also against the regulating or feed wheel. Both wheels are usually of the same material with a surface sufficiently rough to prevent any slipping of the work.

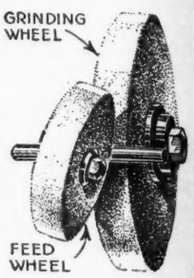



**Fig. 5. Diagram showing principle of the centerless grinder**

In Fig. 3 is shown the wide range of work the centerless machine will handle. It is claimed that by this method, under manufacturing conditions, it is possible to produce work accurate as to size and uniform in quality of finished product. This is aside from production gains.

Another innovation within the past few years is a type of machine using a wide wheel (Fig. 6). This is known as a "plunge grinder," as the wheel virtually is plunged into the work or against a stop set to obtain the desired size. Although built along the lines of the familiar center grinder, the wheel does not traverse the work, but is wide enough to cover the whole length of the piece being ground.

IN THIS type of machine, the wheel is working to capacity at all times. It is claimed that the wheel requires less frequent truing for a given number of pieces. The wheel can be fed into the work either by hand or automatically by power. The wheels for the machine illustrated are 20 in. in diameter and from 2 to 7 in. in width.

Internal grinding, that is, the finishing of cylindrical holes, is accomplished with the aid of internal grinding attachments for standard machines or by special internal grinding machines. The spindle speeds for these machines are considerably higher than those used on the external type, although the surface speed of the wheel is not necessarily higher.

(*Continued on page 143*)

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# Better Shop Methods

## Success in Grinding

(Continued from page 142)

Although usually done dry, some of the special machines for internal grinding are equipped to use water. The wheels are somewhat softer than those used on external work, as the area of contact of the wheel with the work is greater. If the wheel was hard, it would glaze rapidly and heat up the work so that it would be impossible to take accurate measurements.

Tool and cutter grinding is usually done dry, sometimes with special attachments for the standard machine, but more often on machines specially designed for tool and cutter grinding. The wheels should be soft, as they are almost always grinding very hard materials and a hard wheel would be very apt to burn a delicate cutting edge or draw the temper of the tool being ground.

In grinding cutting tools, such as taps, dies, reamers, milling cutters, and the

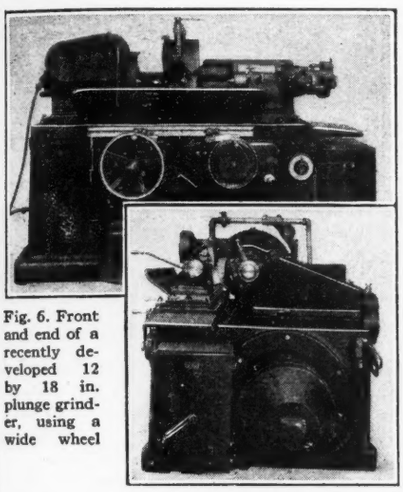


Fig. 6. Front and end of a recently developed 12 by 18 in. plunge grinder, using a wide wheel

like, the wheel should never be forced. Light cuts should be taken so that the wheel will not wear away too much before the cutter has been once around, as any wear on the wheel will result in an out-of-round cutter or reamer.

Another important consideration in grinding tools is to keep the wheel moving across the work when it is grinding. If it is allowed to rest in one spot, it may burn the edge or produce a low spot in the tool.

The relative advantages of wet and dry grinding are somewhat undecided. All kinds of tools are ground dry, but some of the special tool grinders use water or a grinding compound. This undoubtedly is an advantage in grinding twist drills and heavy forged lathe and planer tools.

On production work the coolant serves two purposes: It keeps the work cool and produces a better finish. This has been demonstrated in practice so that wet grinding is a decided advantage in most production work.

*The photographs used in Figs. 1 and 4 are published through the courtesy of the Landis Tool Company; those in Figs. 2 and 3 through the courtesy of the Cincinnati Milling Machine Company, and Fig. 6 through the courtesy of the Cincinnati Grinder Company.*


FARAWAY GETS STATIONS FAR AND NEAR—LOUD AND CLEAR

What FARAWAY Users Say:

**Gets Europe and Coast to Coast**

Your model F is sure some set. I get stations from coast to coast and I also had several European stations last night loud and clear. I'm going to order some more machines very shortly.
*R. A. SCHAEFER, Box 104, Rhome, N. Dakota.*

**Got Europe and Five Orders**

Demonstrated your Model F last night at a party and got Havana, Los Angeles, Oakland and five European stations in silent hour. Sold 5 complete sets. Enclosed are orders. Rush.
*J. D. SHOPTAUGH, Bellevue, Ky.*

**"Crazy" about Faraway**

My customers are just crazy about Faraway sets and I sell them as fast as I order them. We readily pick up Boston, Dallas, Frisco, Pittsburgh and many other stations.
*R. J. ADAMSON, Brampton, N. D.*

**One Sells Another**

I cannot imagine how you can manufacture these Faraway sets and sell them at your retail price. I have been interested in radio sets for several years and I recently had the privilege of "listening in" on one of your 4 tube sets and was surprised at the wonderful results. Send me your literature at once as I want to buy one.
*M. N. J., Salt Lake City, Utah.*

**Got 30 Stations**

Your 4 tube Faraway is fine. So far I've tuned in 30 known stations on the Loud Speaker. Send me a supply of order blanks and literature and expect many more orders.
*A. E. CRAFTS, Pittsfield, Mass.*

European and other Foreign Stations received by FARAWAY Users

Faraway Radio Sets stood the **Big Test.** Mr. R. A. Schaefer of Rhome, North Dakota, was the first to report his success. He writes "I get stations from coast to coast and I also had several European stations last night on the loud speaker, loud and clear." Mr. J. D. Shoptaugh of Bellevue, Ky., Ed. J. Siek and many others report similar success.

Operates Dry Cells or Storage Battery

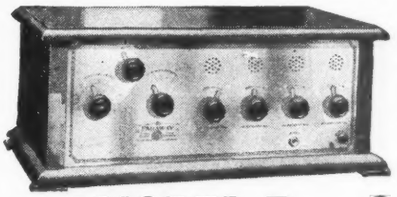
Faraway sets are easily tuned, extremely simple to operate and always dependable. They operate with either Dry Cell or Storage Batteries. The latest improved type of set construction used only on high priced sets is employed.

You, too, can own a FARAWAY with our unique money-saving plan

*You take no chance for we GUARANTEE SATISFACTION or REFUND MONEY*

We guarantee all the things our users claim—namely—clear, sweet tone—fine volume—coast to coast reception—can be logged—no tube howls, distortion of radiation. Furthermore, there are few sets on the market selling for under $100 that can compare in beauty and workmanship with the Faraway Model F for $59.50—you'll agree with us when you see it. For Faraway Cabinets are ornamental and massive—beautifully done in mahogany. The panel is finished in dull platinum with all calibrations finely etched in black.

**SO WHY PAY MORE?** You'll wonder, like Mr. Johnson, how we sell Faraways at these low prices. **OUR UNIQUE SELLING** plan is the answer. Don't buy your radio set until you see Faraway. We have a big surprise for everyone who writes for our literature and money saving proposition. Mail the coupon TODAY.



MODEL F Ⓘ
4 tube set for use with loud speaker..... $59.50

MODEL R
2 tube set shown in illustration above ..... $29.50

*DEALERS—AGENTS*

*Our Faraway proposition offers tremendous possibilities for you. Write quickly for plan and territory.*

THE FARAWAY RADIO CO.
653 W. 3rd Street, Cincinnati, Ohio

MAIL THIS COUPON

THE FARAWAY RADIO CO.
Cincinnati, Ohio.

Gentlemen:
Without obligation send me:
☐ Your literature and details of money-saving proposition.
☐ Agents' Proposition.
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BUY DIRECT FROM THE MAKER
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Either pin shown made with any 3 letters and 2 figures. 1 or 2 colors enamel. Silver plate 25¢ ea. $2.50 doz. Sterling silver. 40¢ ea.. $4.00 doz.
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Unusual opportunity is offered for aggressive, ambitious, hustling men to represent an old established manufacturer of high grade, guaranteed, fastest selling line of Sanitary Twisted in Wire Brushes, sold direct to the Home. We have openings for experienced brush men as managers in all territories. We want live wire, energetic Go-Getters. We pay larger commissions than any other Brush House in the Country. If you want to earn some real money, it will pay you to write us immediately for our proposition. WIRE GRIP SANITARY BRUSH CORP., 15 Mercer Street, New York City.

BUCHSTEIN'S FIBRE LIMB

is soothing to your stump—strong, cool, neat, light. Easy payments.

Guaranteed 5 Years
Send for Catalog Today
Braces for all deformities
P. BUCHSTEIN CO., 610-3rd Ave., So. Minneapolis, Minn.


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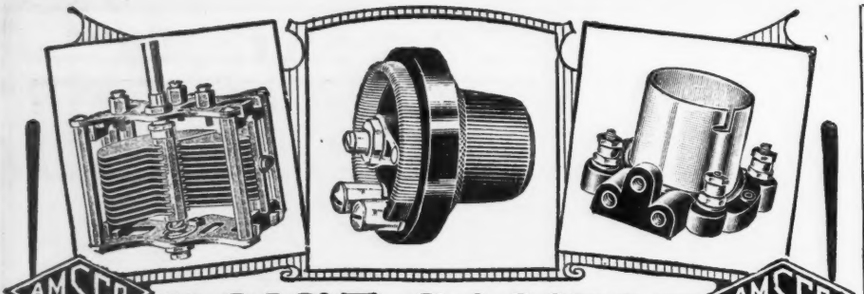


AMSCO AMSCO

# DON'T GAMBLE

in building your set by using inferior parts. You chance the loss of considerable time, money, and patience if the results aren't satisfactory. Be certain! Use only Amsco parts. Made by men who really know their business, they lead the field in all around performance.

Amsco Parts necessary for those who construct their own include the Low Loss Condenser, a laboratory instrument designed for perfection in set building. Also the Amsco Rheostat, for perfect filament control with all types of tubes and the Amsco Tube Socket with genuine Bakelite Base suitable for panel or table mounting.

*At dealers everywhere. Free literature on request*

AMSCO PRODUCTS, Inc., Broome and Lafayette Sts., New York (IS)



# $25.00 in PRIZES

See top of page 10 in front of book for details

## Special Limited Time Offer Gives You This Ideal Home for $1095

***Only a Limited Number Will Be Sold at This Rock Bottom Price***

***HERE IS a home*** so easy to construct that a member of your family (or a friend) can help you build it in a few days.

***Bossert's easy,*** convenient plan of building saves you $500 to $2000. No architect's fee to pay, no builders' waste, no costly construction delays.

***The Albany Model*** is one of our most popular homes. It has four large rooms and bath, all carefully planned for greatest comfort and least housework. For a limited time only it will be sold for this low price.

***Lumber is delivered*** "ready cut." The low price of $1095 includes full plans and specifications; lumber; millwork; plaster board; hardware; paint and varnish. Bossert quality and service guarantees satisfaction.

***Stop paying rent.*** Own your home at a most unusual saving. NOW is the time to buy, and THIS is the house to own.

***Send today*** for illustrated Booklet showing how to finance your building with small first payment, balance after delivery of house.

**Louis Bossert & Sons, Inc.**

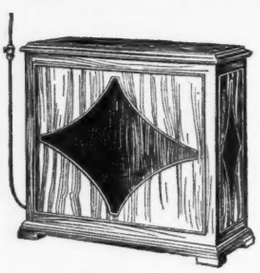
***Largest Lumber Plant in the East***

(House Dept.) 1310 Grand Street

BROOKLYN, N. Y.



## The Question of "B" Battery Current Solved with the Kellogg Trans-B-Former



(IS)

THE Kellogg Trans-B-Former furnishes the necessary plate voltages for your radio set, from your 110 A C, 60 cycle, electric light socket without any interference.

This unvarying current is furnished at less than one-fifth cent per hour. Throw away your "B" batteries and install a Trans-B-Former and your set will operate at maximum efficiency constantly.

The Kellogg Trans-B-Former will:

**Improve reception**
**Reduce operating cost to a minimum**
**Add to the appearance of your set**

Developed, perfected and guaranteed by the Kellogg Switchboard and Supply Company.

At Your Dealers

Each ..... $50

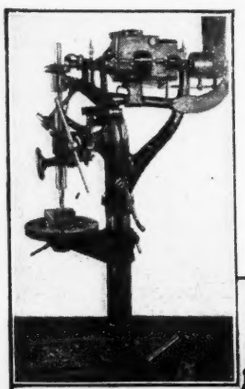
**KELLOGG SWITCHBOARD & SUPPLY COMPANY**

1066 Adams Street Chicago, Ill.

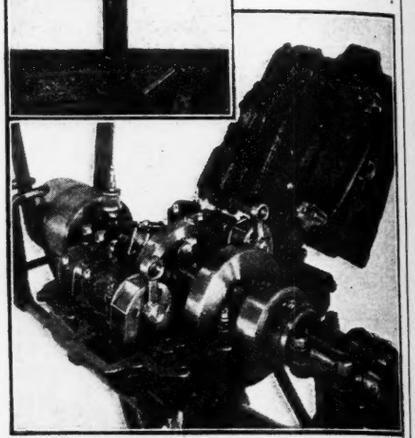

## Better Shop Methods

### New Transmission Controls Speed of Machine Tools

FOR controlling the speed of machine tools and various types of machinery, the variable speed transmission illustrated below was developed recently.



As applied to a drill press, the device allows the speed to be increased or retarded without stopping the drill or shifting belts or gears. The machine may be reversed at once.

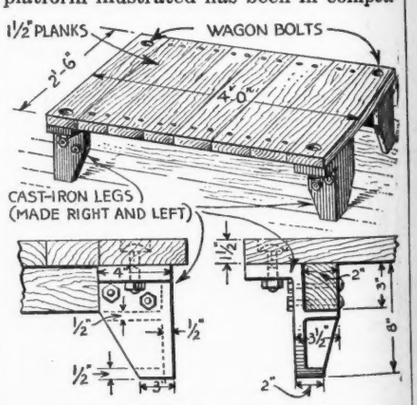


Drill press fitted with new transmission and control mechanism with cover raised

The transmission may be applied to lathes, milling machines, boring mills, and other machine tools, as well as to drills. The mechanism is entirely inclosed and operates in a bath of oil.—A. P. C.

### Shop Loading Platform Built to Resist Hard Usage

MOST of the loading platforms for lift trucks go to pieces in a short time, whether commercial or shopmade. The platform illustrated has been in competition with other designs long enough to prove its superiority over the more usual designs. The special features are the cast-iron leg and the method of putting the platform together.




A heavily built loading platform of a generally useful size, and details of the legs

(IS) This seal on a radio or tool advertisement signifies the approval of the INSTITUTE OF STANDARDS. See page 33.

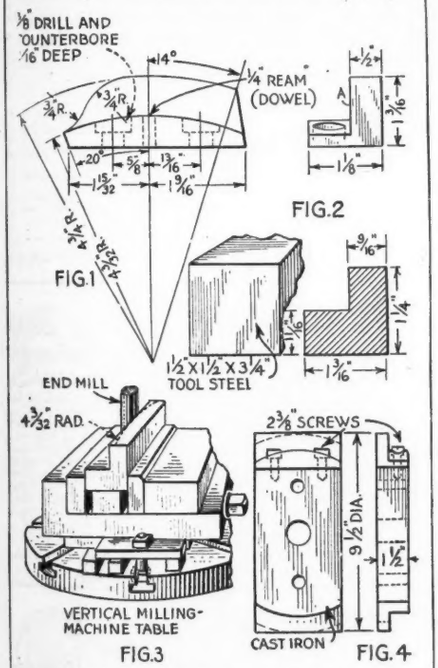
## Better Shop Methods

### How Would You Machine This Awkward Piece?

*HERE'S an interesting machine-shop problem for you. Do you know a better or quicker method of machining the piece illustrated below than that described by the contributor? If you do, send a sheet showing the operations, with whatever explanatory sketches are necessary, to the Editor, Better Shop Methods Department, POPULAR SCIENCE MONTHLY, 250 Fourth Avenue, New York. For each solution that is suitable for publication, POPULAR SCIENCE MONTHLY will pay four dollars.*

THE piece shown in Fig. 1, a tool-steel cam, is to be machined for an experimental job. No special tools are to be used, as only one piece is required. How would you do it?

As a manufacturing proposition it would present no unusual difficulties, but when only one piece is to be made, the




**Steps in machining the cam and iron plate for attaching it to a faceplate**

problem is different. I shall describe the methods used in making this piece in a New England shop and ask the readers of

(*Continued on page 146*)


# BE AN AUTO, TRACTOR, AND ELECTRICAL EXPERT!

If you are earning less than $50 a week, read every word. Why stay in the old job, with no future—no chance of ever earning much more than you are now? The Auto, Tractor and Electrical Business offers thousands of BIG PAY JOBS—jobs where *you* are the BOSS. Get out of the rut—be independent—be an *Auto Expert.*

## The World's Largest Operator of Auto Schools Will Train You

I am the largest operator of Auto, Tractor and Electrical Schools in the world! Think a moment what it means to be trained by McSweeny—the biggest in the industry—Think of the prestige—the ease of getting a big job, when you can say "McSweeny Trained me!" That's the magic phrase that has opened the doors of thousands of big pay jobs to my students.

### Why I am the LARGEST OPERATOR in the World

I have built this chain of schools by giving to my students the best training in the country—by putting every cent back into new equipment—by building the Schools for *you.* The success of this method is easily seen—I am the youngest—but by far the largest and most successful operator in the world. Your future is safe in my hands.

### Eight Short Weeks and then—SUCCESS

Think of it—eight short weeks in any of my schools—Then a big pay job—success! You don't have to know a thing about cars—you don't have to have any education—all you need is the determination to get ahead. In eight weeks you'll be, not merely a Garage Mechanic, but an *Auto, Tractor and Electrical Expert—a big-pay man.*

### FREE R. R. FARE and BOARD

For a very limited time, I am going to pay your Railroad Fare to my nearest school—and board you absolutely free while you are there—And in addition I am going to make you a very special tuition offer. Send today for my *free* catalog. You'll have to hurry, though.

**McSWEENY AUTO, TRACTOR and ELECTRICAL SCHOOLS**

**THREE BIG SCHOOLS**

**Dept. 2610**

McSweeny Bldg. Cincinnati, O. — 517-19-21 South Laflin Street Chicago, Ill. — McSweeny Bldg. Cleveland, O.

USE THIS COUPON FOR MY SPECIAL OFFER

J. H. McSweeny, Pres., Dept. 2610
McSweeny Auto, Tractor & Electrical Schools,
McSweeny Bldg., Cincinnati, Ohio
517-19-21 South Laflin St., Chicago, Ill.
McSweeny Bldg., Cleveland, Ohio
*Send this coupon to the School nearest you*

Dear Mac:
Let me have the full details of your special offer.

Name .....
Address .....
.....

(No facilities for colored students)

# KLEIN PLIERS

That lamp has always needed a new shade and now it's going to get it! Easy enough with Klein Pliers. A pair of Klein's is a real worker and a real playmate. You'll enjoy them for making and fixing things all over the house—for your radio and auto, too. They're thoroughbreds, are Klein Pliers—the result of sixty-seven years of manufacture of pliers. Electrical and telephone companies all *specify* them. Pick up a pair when at your hardware dealer's.

Mathias KLEIN & Sons Established 1857 Chicago, Ill. U.S.A.

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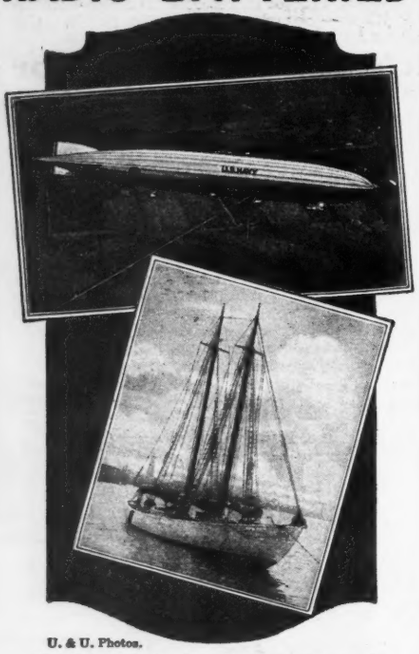
# Further Adventures of BURGESS RADIO BATTERIES



U. & U. Photos.

*The Shenandoah is Equipped with Burgess Batteries and MacMillan Carried them to the Arctic*

**If the quality of any product may be judged in part by the standing of its users, surely Burgess quality must be considered unusually high.**

**Burgess Radio Batteries are found where there's need for the most efficient batteries made—in emergencies where failure brings disaster—with explorers in far-off lands—with the unsung heroes of the air service—beneath the seas with the crew of the submarines.**

**"ASK ANY RADIO ENGINEER"**

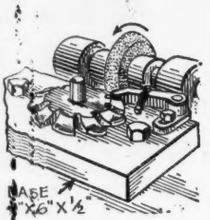
**Send for the Burgess Radio Compass. Surprising—amusing and interesting to the entire family. Sent free of charge from 187 Burgess Engineering Bldg., Madison, Wis. Write for it.**

**BURGESS BATTERY COMPANY**
*Engineers* **DRY BATTERIES** *Manufacturers*
**Flashlight - Radio - Ignition - Telephone**
**General Sales Office: Harris Trust Bldg., Chicago.**
**Laboratories and Works: Madison, Wisc.**
*In Canada:* **Niagara Falls and Winnipeg**

## Better Shop Methods

### Simple Indexing Fixture Aids in Grinding Gear Cutters

A SIMPLE fixture for holding gear-tooth milling cutters while grinding may be made as shown. It consists of a cast-iron plate, machined all over, provided with a stud for holding the cutter, and bolted to the machine table. A stop finger, which is adjustable for cutters of varying sizes, is provided.




Fixture for grinding gear cutters quickly

The cutter is placed on the stud and the finger is adjusted so that the face of the tooth is at right angles to the wheel spindle. No nut is needed to retain the cutter, which can be rotated or indexed easily by hand.

### How Would You Machine This Awkward Piece?

*(Continued from page 145)*

POPULAR SCIENCE MONTHLY for a better or easier way.

A piece of tool steel 1½ in. square by 3¼ in. long was planed to the dimensions shown in cross section (Fig. 2), leaving about .010 in. to be ground. On a surface grinder the sides were ground square and parallel.

The work then was laid out on a surface plate and the 4 3/32-in. radius was scribed. The piece next was set up as shown in Fig. 3, in a toolmaker's vise bolted to a circular milling table on a vertical milling machine. The piece was trued up to the line with a pointer clamped to the mill and the vise was bolted securely.

The 4 3/32-in. radius was milled to the line for a depth of 5/8 in. This operation also finished the face *A* (Fig. 1).

The next operation was to drill and countersink the holes. The 4¾-in. radius then was finished in the lathe by the use of a cast-iron plate, planed as shown in Fig. 4.

The cam was fastened firmly to the plate with ⅜-in. cap screws and the plate was bolted to the lathe faceplate. The work was trued up with the 4 3/32-in. radius already milled. The cast-iron plate had been left long enough to be turned off so that the circle could be measured with a micrometer, as it had to be exact.

The other curved surfaces were not so particular, but could not be turned readily in the lathe on account of the difficulty of holding the piece. The ¾-in. concave radius was made with a mill 1½ in. in diameter and the ¾-in. external radius was milled to the line as closely as possible and finished with a file. The other operations were comparatively simple and need no special comment.

The main difficulty is to machine the circles and there is little room to use a strap strong enough to hold the piece while roughing off the surplus stock.—H. L. W.


# Canada
## *where Dairy Farmers prosper*

Western Canada, blessed with low-priced fertile land, a favorable climate and an abundance of pure water offers remarkable opportunites to experienced dairy farmers.

The rich fertile soil on which nutritious grasses and feed of all kinds grow profusely, can be purchased at an average of $20 an acre—with free use of the land for a year and then 35 years to pay. The yearly payment on an average 160-acre farm is only $195.30. Think of it.

Cash is paid for all dairy products, most of which are used in the nearby cities. Since 1900 the value of Canada's dairy industry has increased $164,000,000. Last year alone Canadian dairy farmers put $54,308,334.04 in their pockets.

Come to Canada where you can put your profits in your pocket, where land prices are low and feed is cheap, where you can double or treble your acreage with the same investment. Both irrigated and non-irrigated lands are available. Investigate now. Send the coupon for full information and details about special inspection trips at reduced fares. Do it now.

Ask the Canadian Pacific about Canada — CANADIAN PACIFIC RAILWAY

**M. E. THORNTON**
**Supt. of Colonization**
**Dept. 512, Canadian Pacific Railway Depot**
**Winnipeg, Manitoba, Canada**

**M. E. THORNTON, Supt. of Colonization**
**Dept. 512, Canadian Pacific Railway Depot**
**Winnipeg, Manitoba, Canada**
I am interested in learning more about:
☐ Prairie Provinces of Canada.
☐ Irrigation Farming in Sunny Alberta.
☐ Business and Industrial Opportunities in Western Canada.
My Name.....
Address.....
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# FORDS ~ Start Easy at Zero
## Nearly double mileage
## 50% More Power ~

The **AIR FRICTION** is the **ONLY** Carburetor which changes ordinary gasoline into powerful, super-heated **DRY GAS VAPOR** which burns up clean, prevents carbon and nearly doubles power and mileage. Leaves no unburned gasoline to run down into crankcase, destroy lubrication and grind out bearings. Motors live two to three times as long with Air Friction. **Fords guaranteed to make 34 miles to gallon.** Other cars in proportion. Try Air Friction **30 days at our risk.** Money back if you want it. Agents wanted. Write today.

**AIR-FRICTION CARBURETOR COMPANY**
**1519 Raymond Building Dayton, Ohio, U. S. A.**

# FREE

## $20 Fine Tone Musical Instruments

We have a wonderful new copyrighted system of teaching note music by mail! To first pupils in each locality we will give free a $20 superb Violin, Tenor Banjo, Ukulele, Hawaiian-Guitar, Banjo, Mandolin, Banjo-Ukulele, Banjo-Mandolin, Cornet or Banjo-Guitar absolutely free. Also teach Piano and Organ. Very small charge for lessons only. Four lessons will teach you several pieces. Over 100,000 successful players. We guarantee success or no charge. Complete outfit free. Write today, Dept. 166. No obligation.
**Slingerland School of Music, 1815 Orchard St., Chicago, Ill.**

## New Wonder of the Seas

(Continued from page 36)

Twenty horsepower is produced by the two motors that spin the towers at the rate of 120 revolutions a minute. They take out of the wind about 1000 horsepower. The inventor claims that each tower produces about 15 times as much propulsive power as that of a similar surface of canvas. An auxiliary engine is used for getting the ship in and out of the harbor.

When the two cylinders are turning at the same speed and the helm is not put "on," the Flettner ship sails normally at right angles to the wind. Changing the speed of one cylinder is said to alter the ship's course just as changing the helm would.

N. W. Akimoff, general manager of the Akimoff Propeller Company, Philadelphia, recently has given an explanation of the Magnus Law as applied to the Flettner ship. He begins by considering what would occur if the two cylinders on the *Buckau* were stationary and the longest dimension of the ship were at right angles to the wind. In that case, says Mr. Akimoff, the wind going around each cylinder would be evenly divided so that there would be no action on the ship.

Then, suppose there were no wind, but that the cylinders were spinning at the rate of 120 revolutions a minute.

THE layers of air directly in contact with the moving cylindrical surface would revolve with practically the same velocity as the cylinder.

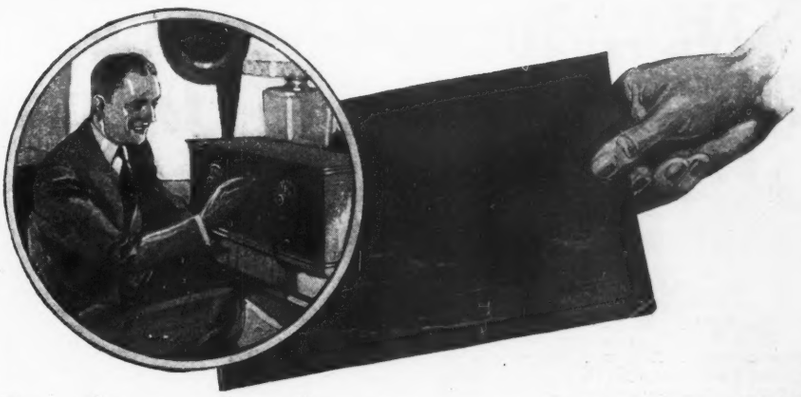
But in the case of the Flettner ship, there is a combination of the two preceding cases—the cylinders spinning and at the same time wind acting upon the ship. Then on one side of the cylinder, the velocity of the wind is opposed by the velocity of the air adjoining the cylinder, thus retarding the velocity of the wind. This means an increase in pressure.

On the other side of the cylinder, the opposite is true. The velocity of the wind combines with the velocity of the air layers next the cylinders, resulting in a decrease in pressure. On one side of the cylinder there is an increase of pressure, on the opposite side a decrease, so that there results a strong force from the stronger to the weaker pressure. This causes the ship to move forward.

THE magnitude of this effect, Mr. Akimoff says, may be computed by multiplying the following quantities: The density of the air, the velocity of the wind, the peripheral or surface velocity of each cylinder, the circumference of each cylinder, and the height of each cylinder. In the case of one of the cylinders on the *Buckau*, considering the velocity of the wind at 40 feet a second, the forward thrust due to the moving cylinder would be 12,000 pounds. Actually, this would be reduced, on account of various losses, to the extent of 10 per cent.

Tests are said to have demonstrated that nearly double the speed made by a sailing vessel equipped with sails can be made by one with the rotor equipment. On its trial voyage the *Buckau* developed

(Continued on page 148)

# Surface leakage exceptionally low with this panel

## *built to order for radio*

THE needs of radio are *special.* Better results have invariably followed the use of apparatus and material designed for its own unique demands.

Radion is a special material, developed to order by our engineers to meet the needs of radio. For radio-frequency insulation its characteristics are highest as proved conclusively by authoritative laboratory tests. Surface leakage and dielectric absorption are shown to be exceptionally low.

Radion is mechanically right, too. It resists warping. No special tools are needed to make a clean-cut workmanlike job. Everybody knows that it is easy to cut, saw or drill. Comes in eighteen stock sizes, two kinds, Black and Mahoganite.

Better performance will make it worth your while to ask for Radion by name, and to look for the name on the envelope and the stamp on the panel. Radio dealers have the exact size you want for your set.

### *You can see the difference by the finish*

You can see that Radion is different if you look at the finish. That high-polished, satin-like surface is not only good-looking but useful as well. Moisture and dirt cannot gather to form leakage paths and cause leakage noise.

**Other Radion Products**

The same qualities of low-loss insulation and attractive appearance characterize Radion dials (to match panel), binding post panels, insulators, knobs, etc.—also the new Radion built-in horn.

### *Send for booklet "Building Your Own Set"*

Our new booklet, "Building Your Own Set," giving wiring diagrams, front and rear views, showing a new set with slanting panel, sets with the new Radion built-in horn, lists of parts and directions for building the most popular circuits—mailed for ten cents.

*Mail coupon today.*

AMERICAN HARD RUBBER COMPANY, Dept. PS 2, 11 Mercer St., New York City

*Chicago Office:* Conway Building

*Pacific Coast Agent:* Goodyear Rubber Co., San Francisco—Portland

RADION

*The Supreme Insulation*

Ⓢ PANELS

*Dials, Sockets, Binding Post Panels, etc.*

American Hard Rubber Company PS2
11 Mercer Street, New York City.

Please send me your new booklet, "Building Your Own Set" for which I enclose 10 cents (stamps or coin).

Name.....

Address.....

City..... State.....

## Fords Get Double Mileage With New Invention

### Simple Device Works Wonders

The most amazing and remarkable invention that has come to light in recent years has just been produced by Robert Martin of Chamberlain, S. D. Fords that were formerly making only 12 to 14 miles on a gallon of gas are now getting from 28 to 43 miles, by using this new attachment. This marvelous invention is a simple affair of aluminum and glass and can be installed by anyone in just a few minutes. In addition to increasing mileage, it filters every drop of gasoline fed to the cylinders and removes every particle of carbon at the same time. Mr. Martin guarantees it to increase mileage on any car and is willing to give one free to any person who will help him introduce it. Write Robert Martin, 800-17 Somers Bldg., Chamberlain, S. D., and ask for his free sample offer.

## FREE RADIO CATALOG Sent You Every Month

ALL the latest improved apparatus is listed in our monthly bulletin: "The American Radio Transmitter." If it's new we have it.

**Lowest Prices in U. S.**

Our prices to dealers are the lowest in the United States. All nationally advertised goods at discounts that make you real money. Dealers, get your name on our mailing list. Simply send name today for latest, big monthly bulletin, showing 75 nationally advertised factory lines and 4,850 items.

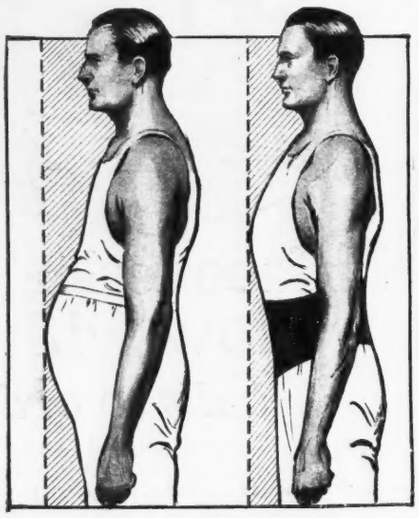
AMERICAN RADIO MFG. CO. 6 W. 14th St. Dept. B, Kansas City, Mo.

Ⓢ This seal on a radio or tool advertisement signifies the approval of the INSTITUTE OF STANDARDS. See page 33.

# NEW Youth-Giving Belt Reduces Waistline ~ Quickly

**Instantly makes you look inches thinner and years younger and actually massages away fat every second while you wear it!**

HERE'S a new easy way to get rid of that bulky, useless, disfiguring fat without any effort on your part! A new kind of belt has been perfected which actually takes off fat in an easy, gentle way—just like an expert masseur! The moment you put on this new self-massaging belt your waist is instantly reduced from 2 to 4 inches! At the same time all your stomach disorders, constipation, backaches and shortness of breath generally disappear as the sagging internal organs are put back in normal place. You are filled with a wonderful new energy, and look and feel 10 to 15 years younger!

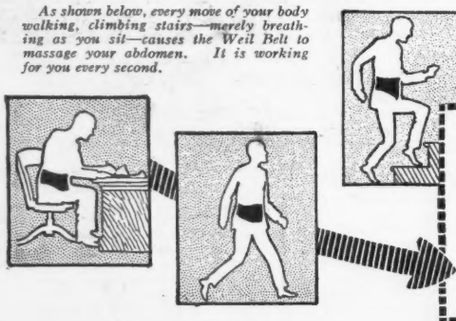


### *Reduce the Way Athletes Do*

The Weil Reducing Belt is made of specially prepared and scientifically fitted rubber. It is so constructed that, as you wear it, every breath you take and every move you make imparts a constant gentle automatic massage to every inch of the abdomen. It works for you every second, day and night, and reduces much more rapidly than ordinary massage.

The Weil Belt is made of the same kind of scientifically treated rubber that is used by hundreds of professional athletes and jockeys, because it not only reduces quickly but at the same time preserves their strength. It is highly indorsed for its healthful principles by physicians everywhere. Satisfaction guaranteed or your money instantly refunded without question.

*As shown below, every move of your body walking, climbing stairs—merely breathing as you sit—causes the Weil Belt to massage your abdomen. It is working for you every second.*



***SPECIAL TRIAL OFFER***

Write at once for full description and details of the Special 10-day Trial Offer being made to The Weil Company, 102 Hill Street, New Haven, Conn.

THE WEIL COMPANY,
102 Hill Street, New Haven, Conn.

Gentlemen: Please send me without obligation complete description of the Weil Scientific Reducing Belt and also your special 10-day Trial Offer.

Name_____

Address_____

City_____ State_____

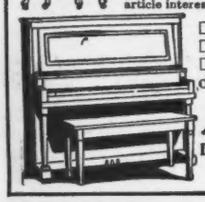
**17c a Day Pays for this Beautiful Rocker**

*Tapestry or Velour*

Over 1000 other bargains. Furniture, Rugs, Lamps, Silver, China, Blankets, Stoves, etc. **Save Big Money** at our Factory-to-Family prices. Pay as little as $3 down; up to a year and a half to pay balance. Get all your Furnishings at once—pay as you use. Thousands buying this new way.

**Big Catalog FREE**

New Spring *"Larkin Book of Better Homes."* Shows everything for parlor, porch, dining-room, bedroom, kitchen. **Bargain Prices** on famous Symphonola Phonographs. Also Symphonic Pianos, Player Pianos in genuine Mahogany, Walnut, Fumed Oak. Free trial. Up to 4 years to pay. Satisfaction or money back. Check below article interested in.



☐ **Home Furnishings**
☐ **Pianos or Players**
☐ **Phonographs**

Cut out this adv.—write TO-DAY for FREE Book.

*Larkin Co Inc.*
Dept. 240, BUFFALO, N. Y.
Peoria, Ill. Chicago, Ill.

# *Play a SAX!*

## *Have Fun*

Nothing will bring you so many friends or make you so popular as being able to play a saxophone. The new York Saxophone is easier to finger, easier to blow.

**6 DAYS FREE TRIAL**

With our free lessons you can be playing popular tunes in a short time. You can get this wonderful instrument, with its superb tone and perfect workmanship on six days' free trial in your own home.

Then if you decide to keep it you can take ten months to pay. Write at once for free saxophone booklet. Other York Band Instruments sent on the same easy terms. Free literature upon request.

YORK
*Nothing to Pay for but Quality*

**J. W. YORK & SONS**
**Dept. 925-B Grand Rapids, Mich.**


## New Wonder of the Seas

(*Continued from page 147*)

an average speed of 4.5 knots (5.2 land miles an hour) in unfavorable weather and in later tests the ship was able to make eight knots (9.2 land miles).

The inventor estimates that with a vessel somewhat larger than the *Buckau*, it would take only 18 days to sail across the Atlantic to the United States. He is planning to make the trip late this year after further experiments.

A NOTABLE feature of the ship is said to be its ease in changing direction. With its towers reversed it is possible for it to sail backward. A three-bladed rudder enables it to turn around in its own length. Any change in course can be made without coming to a stop or slackening speed.

Supporting Flettner's claim to practicability is his own reputation. Anton Flettner is not a newcomer in marine invention. He is recognized by scientists as an experimenter along original lines. An automatic rudder that he invented a few years ago is widely known and used.

Professor Albert Einstein, originator of the theory of relativity, has pronounced the rotor principle of great practical importance. The Hamburg American Steamship Company, for example, became so convinced of its economic value that it has decided to use the rotors in 10 new freighters of 10,000 tons each to be employed on its East Asia route.

On the East Asia route, wind conditions are so favorable to the operation of the rotor ships that the company hopes to save fuel amounting to 60 per cent of that consumed now. Ships equipped with the device sailing from Germany to Rio de Janeiro will make a saving of 50 per cent, it is estimated, while those to New York will save from 35 to 40 per cent.

One of the largest shipping companies in the world is reported to be contemplating using rotor ships as oil-tankers, and steamship lines even are considering them as possibilities for passenger-carrying vessels.

THE inventor himself does not assert that his device will be a substitute for steam or electric power on the high seas. But he declares that while the speed of an ocean liner equipped with revolving towers would not be increased, the invention would save a large percentage of its coal and oil, resulting in a great saving in storage space, as well as in the cost of fuel.

An extremely important line of inquiry developing in the consideration of this device, is whether it will be possible to store electrical energy, created by the rapidly revolving cylinders, in batteries for future use. If this is possible, the world will have a remarkable new means for producing electrical current. Wind, the vast, unknown, unmeasured element, could be harnessed in this easy way to propel anything from farm machinery to an electric power plant.

Flettner has hinted of this. Wind power, he says, eventually may supersede both coal and water power on account of its cheapness.

This seal on a radio or tool advertisement signifies the approval of the INSTITUTE OF STANDARDS. See page 33.

## Henry Ford—"There Is Always Room for More"

(*Continued from page 39*)

superintendents, foremen, and "straw bosses" alike. And Henry Ford, being the supreme executive of them all, himself circulates as they do, though through a wider area.

His interest in and knowledge of the most minute details of the things that are being done throughout his organization is profound, which probably is not remarkable considering that he himself instituted, or at least directed, the adoption of all these methods and policies. He is constantly alert to unearth new developments that may be useful in his work of making better motors. About 500 new ideas a week on the average are given a trial in the Ford organization, sometimes only on a laboratory scale, at other times in gigantic proportions, and the cost of this kind of research reaches a million dollars a week!

SIX hundred acres of flax recently have been harvested at Dearborn as a means of testing the advantages of linen over cotton in the manufacture of the cloth used in motor-cars. There is a plantation in Florida where experts are investigating methods of growing rubber. Sometimes these experiments produce results of immediate practical utility, as for example, when Henry Ford's scientists determined not long ago that rubber, asbestos, and straw, suitably processed, might be substituted effectively for wood in making steering-wheels for Ford cars.

Sometimes such tests yield nothing, which bothers Henry Ford no whit, so long as the experimenter has courage enough and energy enough to try again.

Methods and processes that have been tested and adopted by the Ford organization are not kept secret, nor guarded in any way. They may be borrowed and utilized by any other motor manufacturer or any other industry. Engineers in the employ of André Citroën, sometimes called the "Henry Ford of France," not long ago spent weeks studying the methods of the Ford factories with a view to adopting them in the manufacture of Citroën cars. They were given all possible coöperation.

NOW, whither is all this leading? What may be expected of the Ford Motor Company of the future? We hear frequent prophecies regarding "flivver" airplanes. Often the opinion is expressed that in the future men will journey through the air in tiny, individual planes as casually as they now drive their automobiles through the city streets.

I asked Henry Ford a few days ago whether he ever considered the possibility that the Ford Motor Company might some day be turning its resources to the manufacture of airplanes.

"We are, of course, interested in the airplane motor," he replied, "as we are interested in every kind of motor. We took the lead in the production of airplane motors during the war. We have an airplane landing-field, and we are building a mooring-mast for dirigibles. The

(*Continued on page 150*)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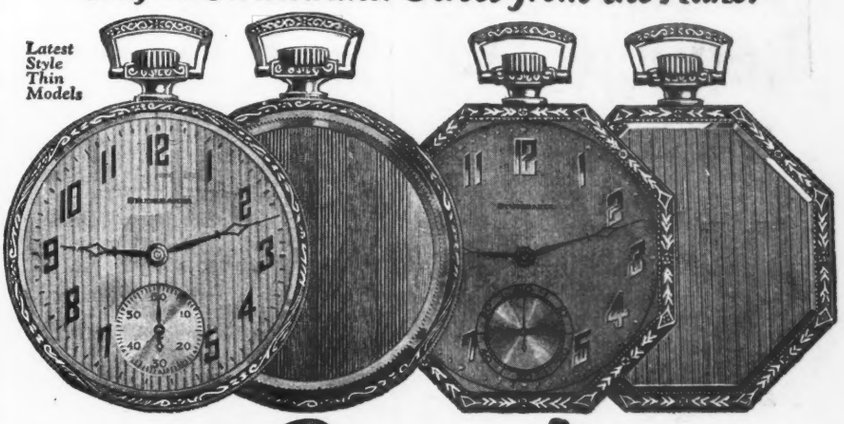

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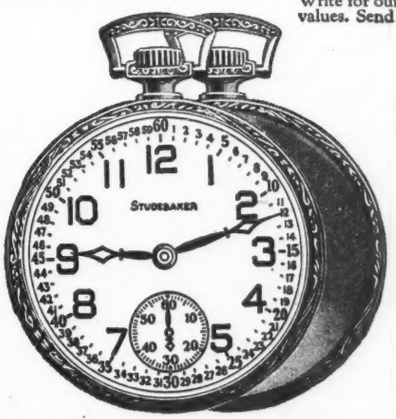

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## Henry Ford—"There Is Always Room for More"

*(Continued from page 149)*

airplane is coming, but it must find its place. What that place will be I shall not attempt to predict.

"CERTAINLY the airplane will not displace the automobile, cause it to disappear, for nothing ever disappears. The automobile and the tractor have not brought about the disappearance of the horse, or of the bicycle. More people are riding horseback today than ever before, and the sale of bicycles keeps well within sight of the peak figures of 25 years ago. Despite the electric light, more candles are being consumed today than at any time in the past. The new thing never entirely displaces the old. When it appears, it merely makes a readjustment necessary; then, when this is effected, with old and new occupying their places of greatest utility, the world goes on much as before, though better, of course, for the improvement that has been made.

"Everything finds its proper place in the world; every person, too, eventually. The automobile has been finding its place gradually for years. When the automobile first came, the world was not quite prepared for it; there were few roads suited to the automobile, but the automobile brought good roads, and it will bring more as they are needed.

"Just now alarm is being expressed in some quarters because the automobile, in the necessary process of finding its place, is causing traffic congestion in our large cities. You frequently hear it said that the world is approaching the 'saturation point' in automobiles. The 'saturation point,' however—the time when the world will have more automobiles than it has room for—never will be reached. You may depend on that. Just as the roads needed by the automobile have been built, and continue to be built, so the congestion that the automobile is causing will be cured, not by double-decked streets, underground roads and cellar parking spaces in the business sections of the big cities, but by the elimination of the necessity for the present crowded business sections.

"THE automobile already has had its effect on the crowded centers of population. It has enabled people to move away from them into the country. It will enable—or even force—business to move into the country, too. When the owners of big stores find that people no longer are coming to them because congestion makes it impossible, they will move out where the people have gone—into the country.

"People are becoming better educated from the automobile; they are becoming better acquainted with one another and more charitable toward one another. They are learning to avoid getting into trouble with one another. Some day it won't be necessary for big buildings where people must go to see lawyers to get them out of trouble. They won't have to go to the big buildings of the cities for other purposes either, for they will have

*(Continued on page 152)*

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## Henry Ford—"There Is Always Room for More"

*(Continued from page 150)*

everything sufficient for their needs close by them in the country. Then there won't be any big buildings, any crowded places at all."

THIS may seem like a fanciful theory. If you live in a large city, even if you merely work in a large city and commute to the country, you'll find it rather difficult to imagine that city some day becoming like its present suburbs. And yet Henry Ford sees this idea exemplified, partly anyway, in his own organization. More than 5000 automobiles, owned by Ford employees, are parked at the River Rouge plant every day, bearing eloquent testimony to the fact that men may motor to their work from as far as 25 miles away without inconvenience.

About the Highland Park plant, six miles approximately from the center of Detroit, there has grown up an industrial community, where stores, shops, banks, theaters and schools make it unnecessary for Ford employees ever to visit the city itself unless they wish. The Ford plan of establishing small industries in rural sections where there are water-power sites already has proved the practicability of linking industry and the farm by supplying farm labor with gainful work between the harvest and planting seasons.

Henry Ford is reputed to be the world's richest man, and the whole world, in consequence, has found its way to his door. You frequently hear it said that Henry Ford is not a philanthropist; that he has not followed the lead of other great industrial leaders in giving large sums to charity. Whether you look on him as a philanthropist depends entirely on how you define the word. He believes that the self-respecting man does not want gifts, but an opportunity to pay his own way; and that is the form that his philanthropy has taken.

HE PAYS the workers in his coalfields from 15 to 20 per cent more than the scale for miners. No worker in his factories receives less than five dollars a day and that only during a 30-day period of training, after which he receives a minimum of six dollars and is transferred from department to department, if necessary, until there is found for him a job at which he can make good.

At the Henry Ford Trade School, boys, who because of educational deficiencies would be likely to remain common laborers, are given a chance to finish their schooling while they earn money and learn a trade. At the $8,000,000 Henry Ford Hospital the best available medical and surgical treatment is offered to all who are ill at a flat rate.

How much the average American workman has benefited through the widespread adoption of the once revolutionary Ford idea of paying the highest possible wages and carrying on an extensive program of welfare work it would be impossible to estimate.

Mr. Ford told me about another intensely practical form of philanthropy

*(Continued on page 154)*


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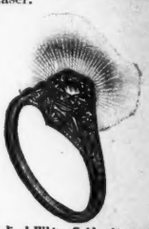

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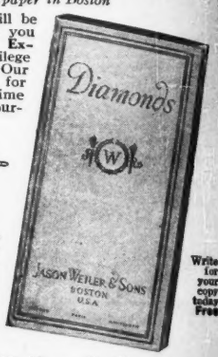


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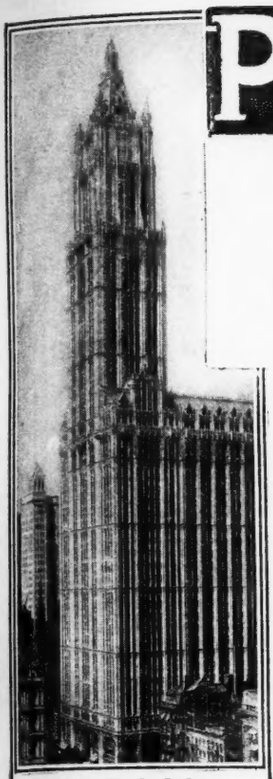

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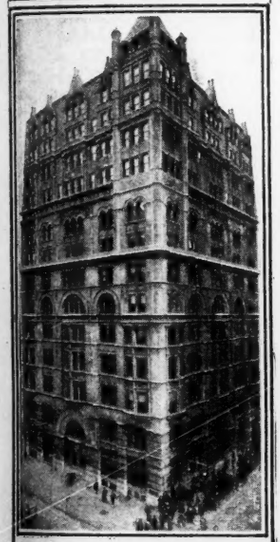

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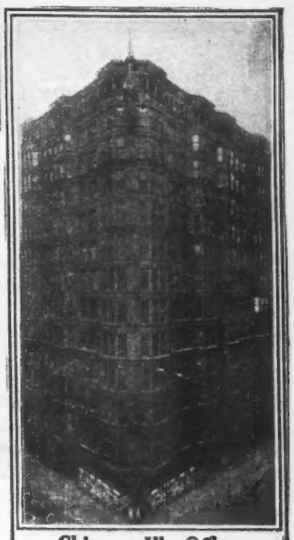

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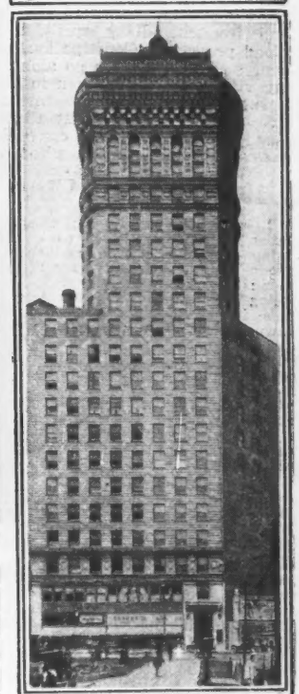

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# Why Many Men Are Old at 40

By Byram C. Kelly, A.M., L.L.D.

I am past 40 myself. I had begun to wonder when I would begin to break—to lose my old-time pep and aggressiveness—when through a mutual friend I made the personal acquaintance of a certain member of the American Association for the Advancement of Science, whose wonderful work I had heard of. I made a trip to his laboratories and the things I learned should interest every man approaching or past the prime of life. Surprising as it may seem, nearly two-thirds of all men past a certain middle age suffer with a disorder of an important gland.

## Common Middle Age Ailments

Here is an important cause for many conditions which heretofore have been taken for granted as old-age ailments—sciatica, aches in the back, legs and feet, frequent nightly risings, nervousness and irritability, and frequent dizzy spells, indicating high blood pressure. Constipation, headaches and depressed spirits often go along with it. But my visit would have been in vain had I not learned of an amazing treatment that relieves this trouble—a treatment that reaches this gland directly—and is so convenient that anyone can apply it in his own home.

## 100,000 Men Find Relief

I know too plainly the effects of gland disorder when it is allowed to continue unabated. I know of the operations and the common saying among many that the average life after this operation is only two or three years. That is why I am doing everything possible to let people know of this important discovery. Statesmen, bankers, lawyers, doctors, men from every walk in life have used the method with success. I have read hundreds of letters from gratified men. One I remember in particular was from a Colorado man which says: "73 years young is my age. Yet for years I suffered with this gland trouble. Used medicine to no avail—had about given up hope when a doctor recommended your treatment." Just think of a man 73 years old restored to the health and buoyancy of youth—without drugs, electric rays or books.

## All Explained in Free Book

If you have this trouble, if you suffer with any of the ailments mentioned above, you should not lose a day in finding out about this wonderful new method. Send immediately for an interesting, free book called, "Why Many Men are Old at 40." It describes this splendid treatment and shows you how you may regain much of your youthful vigor. Send your request to the Electro Thermal Company, 4042 Main Street, Steubenville, Ohio, the concern that is distributing these books for the author. There is no obligation. If you are not interested yourself, you may be able to do an "older" friend an immeasurable benefit by showing him this article. Western Office: Dep. 40-G, 711 Van Nuys Bldg., Los Angeles, Calif.

## Henry Ford—"There Is Always Room for More"

(*Continued from page 152*)

he is about to institute. As a motor manufacturer he has learned that an efficient engine is produced only by use of the best materials, and is kept running efficiently only by use of the best fuel and lubricating oil. He believes—and his opinion is substantiated by leading scientists—that something similar may be true of the human engine.

"I BELIEVE," he said, "that most human ills are directly traceable to food. In manufacture you cannot make your product better than the materials you put into it, and food supplies the materials from which the human body is built up. From proper food a strong body comes, from improper food a weak body. In epidemics some people become sick, others equally exposed, do not. The reason, I believe, is to be found in the differences in physical constitution of the various people, due to the kind and quality of the food they are accustomed to eat.

"Our organization is preparing to tackle this all-important food problem, and to solve it. In our laboratories we have the facilities to perform the necessary research, and through our organization we have the means of applying the knowledge gained in the laboratory and placing information on the food question where it is needed."

Despite the enormous demands that the mere routine of his position make upon him, Mr. Ford finds time to devote himself to a wide range of personal interests. You read, no doubt, how he purchased, renovated and restored a picturesque old inn in New England. He is doing the same thing now to an old inn about 16 miles from Detroit. He is making a collection of old American music and musical instruments. He has a remarkable collection of old American carriages and other vehicles—the "one-hoss shay," the mail coach, and so on.

THESE, he believes, are the documents from which the present generation should learn of the past. That is what he meant when he said recently that history was "bunk." What he meant was history *as written*, colored, and amplified by personal opinion and unfounded legends.

It may interest you to know whom Henry Ford considers the world's greatest scientists. These are the names he himself selected to be carved above the entrance to the new Experimental Laboratory nearing completion at Dearborn, near Detroit:

Darwin, Ampere, Da Vinci, Franklin, Fulton, Whitney, Bell, Marconi, Wright, Burbank, Edison, Burroughs (John Burroughs, naturalist), Kirby (Frank E. Kirby, naval architect, still living at Detroit), Diesel, Faraday, Curie, Otto, Newton, Dunlop (inventor of the pneumatic tire), Pasteur, and Galileo.

That probably would not be your list. I know it would not be mine. But it is Henry Ford's—individual and characteristic, as is everything he does.

$3 DOWN brings genuine

UNDERWOOD

*Yes,* only $3 down puts this genuine standard Shipman-Ward Rebuilt Underwood in your home. Then—small monthly payments, or if convenient, pay cash. Either way you get the *world's standard* typewriter at a big cash saving.

WHY PAY RENTAL?

Think of it! You pay little more than rental, and the machine is yours! We offer the same three models of the Underwood Typewriter which are being made and sold by the Underwood Company today. The only difference is that Shipman-Ward machines are priced lower and are rebuilt like new by experts. You can't tell them from brand new machines. Visible writing—the FULL LINE of typewriting is visible at all times. STANDARD 4-ROW SINGLE SHIFT KEYBOARD. Two color ribbon, back spacer, stencil device, automatic ribbon reverse, tabulator, etc.

TEN DAYS' FREE TRIAL

See for yourself! Try the typewriter ten days. You must be satisfied or the entire transaction won't cost you a penny. Act today. Get our big illustrated catalog and full particulars. Write NOW.

----FREE TRIAL COUPON----

Typewriter Emporium
SHIPMAN-WARD MFG. CO
2142 Shipman Bldg., CHICAGO

Send by return mail Bargain Offer No. 2142, of a Standard Visible Writing Underwood. This is not an order and does not obligate me to buy.

Name .....

Street or R. F. D. No. .....

Postoffice ..... State .....

PATENTS

To the Man With an Idea

I offer a most comprehensive, experienced, efficient service for his prompt, legal protection and the development of his proposition.

Send sketch, or model and description, for advice as to cost, search through prior United States patents, etc. Preliminary advice gladly furnished without charge.

My experience and familiarity with various arts, frequently enable me to accurately advise clients as to probable patentability before they go to any expense.

Booklet of valuable information and form for properly disclosing your idea, free on request. Write today.

RICHARD B. OWEN
Patent Lawyer
6 Owen Building, Washington, D.C.
2276-D, 41 Park Row
Cortland 0721 New York City

## Two-Cent Trails of Peril

(*Continued from page 53*)

and shelter. His frozen body was found by the roadside. For the first time in his long career he had failed to deliver the mails.

Dreahn's case may be taken as typical of the perils of the postal trail. A tragic companion picture is afforded by the fate of more than one carrier on the star route between Rocky Bar and Atlanta, in Idaho. The journey is made on snowshoes, for no ordinary vehicle could complete the journey. Traveling afoot, the man with his 50-pound burden of mail is at the mercy of the storm.

IN THIS part of the Idaho mountains the avalanche is a frequent visitor, moving with a force from which there is no escape. Postal records show that a number of carriers have been buried in these monster slides. One of last year's victims was missing for months. Half a year after his disappearance, the carrier's body was found where he had been engulfed by the snow. His mail bag lay at his side.

On the coast of Oregon there is a mail route that is made especially dangerous by the tides of the Pacific. Between Otter Rock and Newport this route follows the beach beneath a line of rugged cliffs. Carriers are supposed to traverse this stretch at low tide, but sometimes the carrier is caught by the rising tide. At such times he faces the danger of being dashed against the cliffs by the rush of waters, and can escape only by scaling the rocks. Many carriers have had narrow escapes on this route.

Utah has a mail route on which the winter problems are extremely marked. Heavy snows and deep drifts formerly made the mountain roads impassable for a good part of each year. Blockades of mail wagons were common.

THIS condition prevailed until the introduction of the high-powered motor-truck. With this vehicle the Post Office Department has found it possible to buck the drifts and keep the route open throughout the winter.

Expensive? Of course. This route, from Price to Vernal, is the costliest star route in the United States. To carry the mails between the two offices involves an annual outlay of something like $100,000. The distance is 121 miles. In a case of this kind, however, the government does not count the cost. The people of the isolated mountain regions are entitled to their mail as much as the city folk.

On many of the star routes airplanes would seem to offer solution of problems with which the postal authorities have fought from the beginning of the mail service. Winter air passage across the Rocky Mountains already is regarded as a foregone conclusion in connection with the air-mail between New York and San Francisco. Plans for this route contemplate service every day in the year. Mountain storms and surface blizzards are to be disregarded. There seems to be no reason why similar defiance of the elements could not be practised on the shorter dangerous routes.


**$1662.00 Earned IN ONE SEASON**

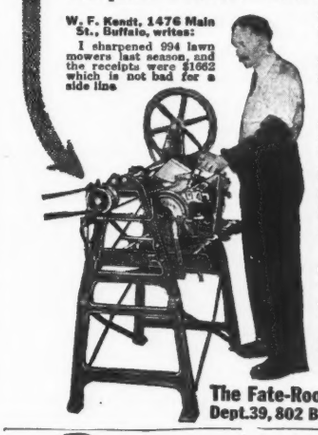
**A NEW BUSINESS—BIG BUSINESS**

**A Business to Enthuse Over—**
**The "Ideal" Lawn Mower Sharpener**

*A wonderful invention that sharpens lawn mowers scientifically—quickly—perfectly; does the work as nothing else can.*

**Fred C. Milkert of Melrose Park, Ill., writes:**
"The Ideal Lawnmower Grinder put me in business, starting in the basement of my home and forcing me now for the third time to move into bigger quarters. Today the dream of my life—a shop of my own—is realized. With a machine like yours and a little hustle any man can have a business of his own and be independent."

**You Start Now** No town is too small. Lawn mowers are dull—owner doesn't know where to get them sharpened. Mowing the lawn dreaded because of dull or improperly sharpened mower. Lawn mowing is healthful, invigorating and pleasant when Mower is "Ideally" sharpened. You do the work scientifically—you are in big demand.


W. F. Kendt, 1476 Main St., Buffalo, writes:
I sharpened 994 lawn mowers last season, and the receipts were $1662 which is not bad for a side line

**Lawn Mowers Sharpened to Razor Edge—**

People glad—owners delight in mowing lawn with mower sharpened on an **"Ideal."** Mower runs light—click-click-click and the grass is cut. Build permanent business for yourself. Start now!

**Write Today**
Get our proposition Free We have detailed illustrated book to send you. Write today for our proposition.

**USE THIS — MAIL IT TODAY**
The Fate-Root-Heath Company
802 Bell St., Dept.39, Plymouth, O.
Please mail at once details of your complete proposition.

*Name* .....
*Address* .....
.....

**The Fate-Root-Heath Company**
**Dept.39, 802 Bell St., Plymouth, O.**

**Wear this Shirt and Earn $75 to $100 A Week**

With or without experience, you can easily earn $75 to $100 a week taking orders for the famous FASHION WEAR shirts. Wear one of them and show to your friends. Every man a customer. Finest quality at low factory prices. Sales quick and easy. Some salesmen are earning as high as $175 a week. We send you Free complete sample outfit with wonderful swatches. You take the order. We deliver.

START NOW and build a permanent, profitable and fascinating business of your own. Collect your profit in advance and always have money. These remarkable shirts are selling amazingly fast, and sales are good all year round. We help you sell and give you a fair share on every shirt sold. If you really want the best money-making work anywhere write immediately for full information. Act before someone else grabs the rich territory that you can have. A post card will do. Address

*Charles Hope,* **THE FASHION WEAR CO.**
**1200-20 Jackson St., Dept. 72, Cincinnati, Ohio**

How to Build
**ULTRADYNE**
**MODEL L-2**

32 page illustrated book with detailed instructions on drilling, wiring, assembling and operating Model L-2 Ultradyne Receiver. Latest authentic edition by R. E. Lacault, A.M.I.R.E., inventor of the Ultradyne, the most selective receiver known. Write for descriptive circular.

**PHENIX RADIO CORP.**
5-7-9 Beekman St., N. Y.

**INVENTORS PROTECT YOUR IDEAS**

Send for our Guide Book, **HOW TO GET A PATENT,** and Evidence of Invention Blank, sent Free on request. Tells our terms, methods, etc. Send model or sketch and description of your invention for our **Instructions. No Charge for the Above Information.**

**RANDOLPH & CO.**
**Dept. 130. Washington, D. C.**

NAME.....
STREET.....
CITY.....STATE.....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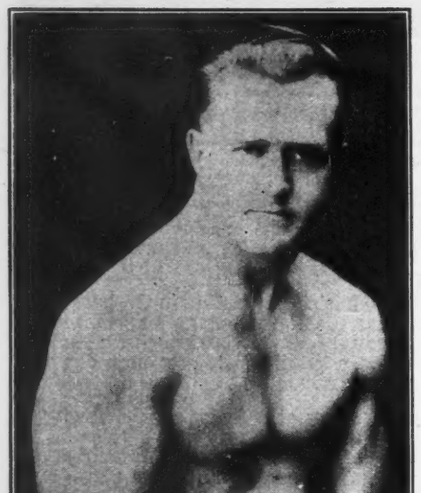


EARLE E. LIEDERMAN
*The Muscle Builder*

# A Wart On Your Nose

would not be noticed nearly as much as a frail, weak body. Yet, if you had a wart on your nose, you would worry yourself sick—you would pay most any price to get rid of it. But what about that body of yours? What are you doing to make people admire and respect you? Wake up! Come to your senses! Don't you realize what a strong, robust body means to you? It makes no difference whether it be in the business or social world—everybody admires the strong, robust fellow—everyone despises the weakling.

## I Will Transform You

I make weak men strong. That's my job. That's why they call me "The Muscle Builder." I never fail. A bold statement, but true. I don't care how weak you are, I can do the trick. The weaker you are, the more noticeable the results. I've been doing this for so many years, it's easy now. I know how.

In just thirty days, I'm going to put one full inch on those arms of yours. Yes, and two inches on your chest. But that's nothing. I've only started. Now comes the real work. I'm going to broaden your shoulders and strengthen your back. I'm going to deepen your chest so that every breath will literally penetrate every cell of your lungs, feeding them with rich life-giving oxygen. You will feel the thrill of life glowing throughout your entire system. I'm going to tighten up those muscles in and around your heart, kidneys and stomach. I'm going to shoot a quiver up your spine so that you will stretch out your big brawny arms and shout for bigger and harder tasks to do. Nothing will seem impossible.

Sounds good, doesn't it? You can bet your Sunday socks it's good. It's wonderful. And the best of it is, I don't just promise you these things—I guarantee them. Do you doubt me? Come on then and make me prove it. That's what I like.

Are you ready? Atta boy! Let's go.

**Send for my new 64-page book**

## "MUSCULAR DEVELOPMENT"

***It Is FREE***

It contains forty-three full page photographs of myself and some of the many prize-winning pupils I have trained. Many of these are leaders in their business professions today. I have not only given them a body to be proud of, but made them better doctors, lawyers, merchants, etc. Some of these came to me as pitiful weaklings, imploring me to help them. Look them over now and you will marvel at their present physiques. This book will prove an impetus and a real inspiration to you. It will thrill you through and through. All I ask is ten cents to cover the cost of wrapping and mailing and it is yours to keep. This will not obligate you at all, but for the sake of your future health and happiness, do not put it off. Send today—right now, before you turn this page.

**EARLE E. LIEDERMAN**
**Dept. 1302 305 Broadway New York City**

---

**EARLE E. LIEDERMAN**
**Dept. 1302, 305 Broadway, New York City**

Dear Sir:—I enclose herewith 10 cents for which you are to send me without obligation on my part whatever a copy of your latest book, "Muscular Development." (Please write or print plainly.)

Name_____

Street_____

City_____ State_____


## First Aid for Your Family

*(Continued from page 54)*

cold, and by its use sometimes one is enabled to relieve the discomfort and to get a fair night's sleep. In the use of drugs such as this, for the relief of headache and pain generally, it must be remembered that repeated doses at short intervals are unwise and even may be dangerous.

For the treatment of skin inflammation caused by poison ivy or poison oak, sometimes simple home remedies give relief. The best of these is a thorough scrubbing with kitchen soap and a soft brush and warm water, followed by the application of some soothing ointment such as zinc ointment or chloramine-T paste.

THERE should be included in the medicine cabinet a harmless stimulant for the treatment of fainting not due to an organic cause, nervousness, or giddiness. Such a stimulant is aromatic spirits of ammonia. This may be inhaled as a quick stimulant or, diluted with water, it may be drunk for a more lasting effect.

Where there are children and adolescents, nose-bleed and other slight external hemorrhages frequently occur and require home treatment. Bleeding from the nose usually may be stopped very effectively by the use of agents that produce a normal clot. Such an agent is thromboplastin, prepared from tissues of animals that are richest in the clot-promoting elements. A pledget of sterile cotton or a piece of gauze saturated in thromboplastin and placed in the nose in case of nosebleed, or into the cavity of an extracted tooth, will stop ordinary bleeding almost instantly.

We have been hearing a lot in the past year or so about vitamines and how necessary it is that we should get a sufficient amount of them by a properly diversified diet; but the difficulty has been to get people to take a diet that is sufficiently diversified and adequate to supply the needs of the body in this respect.

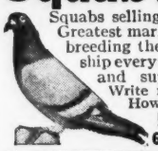
This has been particularly the case with those vitamines called the "fat soluble vitamines," which are concerned with the normal growth of children, and the prevention of rickets.

THE two most concentrated sources of these vitamines are good butter and cod liver oil, but not emulsions of cod liver oil. The best cod liver oil contains more than 100 times more fat soluble vitamines than does the best quality of creamery butter, and should therefore be included in every medicine cabinet of those homes where there are children. Regular courses of cod liver oil should be given three or four times a year to insure that the growing child receives the necessary amount of the fat soluble vitamines.

There should be added a supply of a good dental cream free from gritty abrasives and with little or no soap; cold creams, zinc stearate, talcum and nursery powder for the baby; also a supply of sterile bandages and gauze of assorted sizes, and a good clinical thermometer.

The householder should never lose sight of the important fact that the contents of the medicine cabinet are intended only for the relief of symptoms the severity of which apparently do not require the services of a physician.


## Squab Book FREE



Squabs selling at highest prices ever known. Greatest market for 20 years. Make money breeding them. Raised in one month. We ship everywhere our famous breeding stock and supplies. Established 24 years. Write now for big illustrated free book, How to Make Money Breeding Squabs.
**PLYMOUTH ROCK SQUAB CO.**
**616 H St., Melrose Highlands, Mass.**

## FORD RUNS 57 MILES ON GALLON OF GASOLINE

A new automatic and self-regulating device has been invented by John A. Stransky, 4339 Fourth St., Pukwana, South Dakota, with which automobles have made from 35 to 57 miles on a gallon of gasoline. It removes carbon and reduces spark plug trouble and overheating. It can be installed by any one in five minutes. Mr. Stransky wants distributors and is willing to send a sample at his own risk. Write him today.—Adv.

## Motorcycle Bargains

**SAVE 25% to 65%**

on Slightly Used and Rebuilt Motorcycles, Ace, Indian, Excelsior, Harley-Davidson, Cleveland, Side Cars, Johnson Motor Wheels, Evans Power Cycles, Bicycles. Send for **Free Bargain Bulletin and Money Saving Message,** listing hundreds of bargains in used, rebuilt and new machines, supplies, accessories, etc.
**AMERICAN MOTOR CYCLE CO.**
**Dept. 228 2047 W. Chicago Ave. CHICAGO**

## "LIGHTING FIXTURES"

Ready to hang.
Direct from the manufacturer.
Completely wired including glassware.
**Send for Catalogue No. 26**
*(Just off the press)*
Special proposition to Dealers
**ERIE FIXTURE SUPPLY CO.**
**Desk A Erie Pa.**

## DEAFNESS IS MISERY

I know because I was Deaf and had Head Noises for over 30 years. My invisible Antiseptic Ear Drums restored my hearing and stopped Head Noises, and will do it for you. They are Tiny Megaphones. Cannot be seen when worn. Effective when Deafness is caused by Catarrh or by Perforated, Partially or Wholly Destroyed Natural Drums. Easy to put in, easy to take out. Are "Unseen Comforts." Inexpensive. Write for Booklet and **my sworn statement** of how I recovered my hearing.
**A. O. LEONARD, Suite 301, 70 5th Ave., New York**

## *Class Rings and Pins*

**Largest Catalog Issued—FREE**

CATALOG FREE

Samples loaned class officers. Prices $.20 to $8.00 each. No order for class, society, club emblems too large or too small. Special designs made on request.

**METAL ARTS CO., Inc., 7706 South Ave., Rochester, N. Y.**

## MOVIES IN YOUR HOME

Our marvellous, practical MOVIE MACHINES sell as low as $3.75 postpaid and use same size film as big theatres. We also have wonderful films at lowest prices—with a new film exchange service. DON'T MISS THIS!
*Write NOW for free catalogue*
**PARAMOUNT MFG. CO.**
**Dept. PS 7 Boston, Mass.**

## LATEST WHOLESALE RADIO CATALOG FREE

Simply send name TODAY for big 48-page catalog of latest radio goods at Wholesale.
*Live dealers and agents wanted.*
**STANDARD RADIO CO., 104 East 13th, Kansas City, Mo.**

You've heard your neighbor praise this wonderful weekly magazine that 3 million people read. Unbiased digest of national and world affairs. Chock full of just the kind of reading you want. Science, politics, travel, fun, fashions, question box, books, health—entertainment and instruction for all. Send 15c (coin or stamps) today for this big paper on trial 13 weeks or $1 for 1 year (52 issues).
**PATHFINDER, 559 Langdon Sta., Washington, D. C.**


**This seal on a radio or tool advertisement signifies the approval of the INSTITUTE OF STANDARDS. See page 33.**

## Here Are Correct Answers to Questions on Page 78

1. This is an effect of the hair cells going on strike. Instead of merely refusing to make color, they refuse to make hair at all. Poor nourishment is the most frequent cause. Scalp massage or anything that stimulates the circulation of blood in the scalp will sometimes cure baldness provided the hair cells are not dead.

2. Very few, if any, of the chemical impurities are removed by boiling. But boiling does kill the germs in the water.

3. Under ordinary conditions on the earth's surface the lightest substance known is hydrogen gas. This is why hydrogen is used to fill balloons. The helium gas, which is now replacing hydrogen for this purpose, is not quite so light as hydrogen, but possesses the great advantage of being non-explosive.

4. Because the resistance of the air is greater. The snowflake is much less compact than the raindrop. The friction of the air against it is therefore more easily able to counteract its weight.

5. Many of them have motions that we can measure by comparing their present place in the sky with their place several years ago. Others are shown by the spectroscope to be moving toward or away from the earth, this being detected by a change in the character of the light.

6. Light travels faster; it is the fastest thing in the universe. The speed of electricity depends on what it is traveling in. It may go a good many thousand miles in a second, but it never reaches light's speed of 186,000 miles a second.

7. No. The brain of an insect is not only much smaller than ours, but it is put together in a very different way. Many of the things that insects do are not controlled by the brain, but by little knots of nervous tissue in the body.

8. The radio waves are not waves in matter; they are waves in the ether, a medium that we believe fills all space even out to the most distant stars. The atoms of matter are quite open in structure, with a great deal of space between the solid parts of them. The ether is supposed to penetrate into these spaces inside atoms. Accordingly the radio waves go right through the atoms of matter.

9. No. It used to be thought that certain foods, especially fish and other foods containing phosphorus, were especially valuable for the gray matter of the brain. But it is known now that brain cells apparently use the same food materials as all other living cells. The best way to feed your brain well is to keep your body in good health.

10. A parrot happens to have a set of vocal cords and a formation of the throat capable of imitating many sounds, including human speech. There is no reason to believe that parrots ever understand what they are saying.

11. Because it is all around us and inside of us as well as on top of us. When you hold out your hand, the air pressure on top of it is about three hundred pounds; but an equal pressure is being applied all the time to the under surface of your hand also.

12. A geyser is a kind of hot spring. There is a long tube or tunnel that reaches down into the hot rock. Water accumulates in this tube and steam pressure begins to develop at its lower end. Finally this steam pressure gets high enough to blow out all the water in the tube. This makes the geyser spout. The procedure is continuous.


THEY SAY OF THE NEW SUPER-ZENITH:

"Greater clarity and volume. Amplification is always at a maximum in each stage for any wavelength. Three stages audio frequency amplification."

*Zenith amplifies with Thordarsons!*

THEY SAY OF THE KENNEDY:

"The Kennedy tone quality is superb; full-rounded, musically pure reproduction of any program within a good long range. No hollow tones or distortion. For the Kennedy is a *musical instrument.* A musician will enjoy its purity of tone."

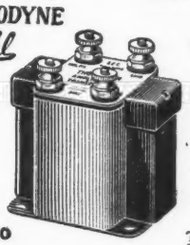
*Kennedy amplifies with Thordarsons!*

THEY SAY OF THE MURDOCK NEUTRODYNE:

"To hear the real voice of the nation full and clear—you want volume. . . . Volume that floods your room. . . . Distant stations can be tuned in with remarkable clearness and volume."

*Murdock amplifies with Thordarsons!*

ZENITH KENNEDY Wl Radiodyne CL Pathé ULTRADYNE MURDOCK MICHIGAN Howard OZARKA THERMIODYNE Pfanstiehl PHENIX DERESNADYNE MALONE LEMON AUDIOLA GATES GLOBE HARMONY ODELL FERRY PEERLESS MASTER RADIO MUSIO SAAL AND MANY OTHERS



## Superiority Proved!

Note the emphasis placed upon *tone quality* in the advertising of the finest sets—the sets that have Thordarson amplification. People want radios that are *musical instruments.* Leading makers are responding with sets embodying the best audio amplification. That is why *more* Thordarsons than all competitive transformers combined are now used in high-grade radios.

Is your present set disappointing? Buy a Thordarson-equipped set—or replace your audio frequency transformers with a pair of Thordarsons—or follow the lead of the leaders and build with Thordarsons. You will be delighted with the even volume they deliver over the *entire* musical range. If your dealer is sold out, you may order from us by mentioning his name. Interesting bulletins sent free. Write.

THORDARSON ELECTRIC MANUFACTURING CO.
*Transformer specialists since 1895*
WORLD'S OLDEST AND LARGEST EXCLUSIVE TRANSFORMER MAKERS
*Chicago, U.S.A.*

Unconditionally Guaranteed

THORDARSON Super AMPLIFYING TRANSFORMERS

*Standard on the majority of quality sets*

TYPES AND PRICES: Thordarson "Super" Audio Frequency Transformers are now to be had in three ratios: 2-1, $5. 3½-1, $4. 6-1, $4.50. Thordarson Power Amplifying Transformers are $13 the pair. Thordarson Interstage Power Amplifying Transformer, $8. Write for latest hook-up bulletins—free!

## Earns Big Money

**J. Gordon Says $4000 Profit In 2 Months!**

**Making and Selling Popcorn Crispettes**

GEORGE ALEXANDER, of Pennsylvania, **made $3,000.00 in 4 months.** Ira Shook, Flint, took in **$365.75** in one day. Bram bought one outfit, then 10 more within a year. Mrs. Lane, Pittsburg, sold **8000 packages** in one day. J. R. Bert, Ala., wrote, "only thing I ever bought that equaled advertisement." Patillo, Ocala, writes: "Crispettes all you claim and then some." Kellog, **$700 ahead end of second week.**

**WE START YOU IN BUSINESS!**

Furnish secret formulas, raw material, and equipment. Small capital required; no experience needed.

**Build Business of Your Own**

No limit to the sale of Crispettes. Everybody likes them. It's a delicious food confection made with or without sugar. Write for facts about a business that will make you independent. Start in your town.

**Profit $1000 Month Easily Possible**

Send postal for illustrated book of facts It contains enthusiastic letters from others—shows their places of business, tells how and when to start, and all information needed. Free. Write now!

**Long-Eakins Co. 247 High St. Springfield, O.**

APEX VERNIER DIAL

**It Brings 'Em In!**

Get more stations—greater range—bigger volume—finer selectivity—less interference. Lasts forever. The one big advance yet made in tuning. Ratio 12 to 1. Quickly applied to any shaft. For sale by all good Radio Dealers. If unable to obtain from dealer, enclose $2.50 for nickel-silver finish, or $3.50 for De Luxe satin finished gold.

**7-Tube Super-Heterodyne for $97.50**

Receive the parts complete to assemble your own set. Coast to coast on an 18-inch Loop. Assemble this 7-tube Microdyne super-heterodyne on a 7x18 in. panel in three hours. Parts complete, including drilled and engraved panels, condensers, sockets, transformers, dials connecting plugs, cables, etc., with drawings, diagrams and instructions. Price of cabinet—to fit—on application. If your radio dealer cannot supply parts for complete Microdyne Radio Set, send check or money order for $97.50 and name of your dealer.

**APEX ELECTRIC MFG. CO., Dept. 203**
**1410 W. 59th Street, CHICAGO**

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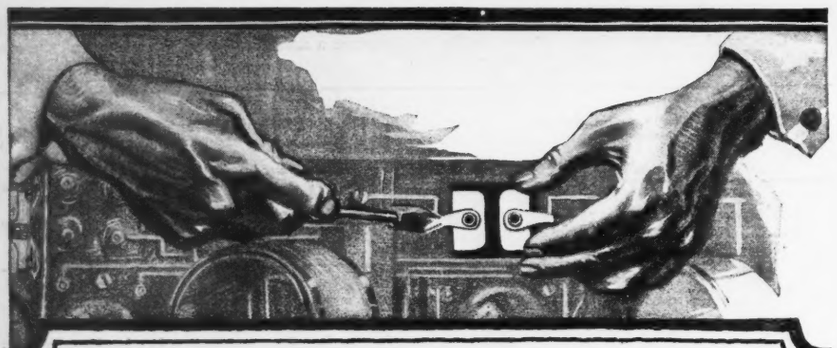

# Nine out of ten sets use MICADONS!

Nine out of every ten sets made use Micadons—the standard fixed radio condenser. Set builders choose them for many reasons.

*They know* that the Micadon is a Dubilier product, hence supreme in quality and efficiency.

*They know* that Micadons can be obtained in accurately matched capacities and that the capacity is permanent.

*They know* that Micadons are easily installed, equipped as they are with extension tabs for soldering and eyelets for set screw assembly.

*They know* that Micadons are made with type variations to meet every possible requirement.

*For the best results use MICADONS.*

Ⓢ

# Dubilier

CONDENSER AND RADIO CORPORATION



## How to Get a Position with the U. S. Government

Thousands of appointments are made yearly. Good salaries—short hours—liberal vacations (as much as 30 days in some branches of the service). Positions open now in Washington and in other cities.

"Pull" and influence unnecessary. Common school education sufficient as groundwork for most positions. The International Correspondence Schools will prepare you right at home to pass your Civil Service examination with a high mark.

***Mail the coupon today for 48-page Free Civil Service booklet.***

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Without cost or obligation, please send me a copy of your 48-page CIVIL SERVICE BOOKLET, which tells how I can secure a good-paying position with the U. S. Government.

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**AGENTS make $25 to $75 a Day**

## Man Alive—
## *Look What You're Missing!*

Oliver men are cleaning up. Making $25 to $75 a **day!** It's the chance of a lifetime. Don't lose another minute. Write. Big season now on. Learn how easily **Oliver Oil-Gas Burners** sell. Amazing invention. Burns Oil, mixed with air. Better heat than coal or wood. Fits into fire box of range or heater. Models for all types of furnaces, too. 12 models in all. Appeals instantly. Turns any range into a gas stove. Wonderful, glowing heat, at the turn of a valve. A few minutes' demonstration makes the sale.

**Yes Sir, It Sells Itself! ACT *NOW!***

Every woman wants one the minute she sees it. Every buyer recommends it. Means more sales for you! The **Oliver** is a winner. Greatest burner ever. Saves women the drudgery of shoveling and carrying coal, building fires, scraping out ashes. Keeps furnishings clean. Priced within everyone's reach. Saves its cost a hundred times over. Can you think of anyone wanting to be without it?

## OLIVER OIL-GAS BURNER

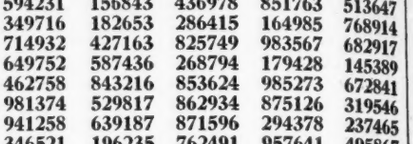
You don't need to be a high-powered salesman. Sell only one Burner a day and you've made $75 a week. Think of it! And *we guarantee your first sale.* Over 200,000 already sold. Get our Free Sample Case offer.

**OLIVER OIL BURNER CORPORATION**
***Manufacturers of Oliver Oil-Gas Burner Products***
**259 OLIVER BLDG. ST. LOUIS, MO.**
*Oldest and Largest Manufacturers of Oil-Gas Burners in the World*


## Can You Pass These Tests?

(*Continued from page 45*)

| | | | | |
|---|---|---|---|---|
| 867314 | 739548 | 382145 | 672539 | 378652 |
| 963458 | 371629 | 596743 | 784623 | 358472 |
| 345962 | 294736 | 198537 | 916483 | 635819 |
| 672389 | 389254 | 259671 | 123874 | 329418 |
| 312876 | 427395 | 561487 | 593182 | 247153 |
| 934612 | 759431 | 281937 | 461289 | 579361 |
| 954178 | 718254 | 296851 | 524617 | 731825 |
| 719325 | 486592 | 215367 | 714529 | 956142 |
| 594231 | 156843 | 436978 | 851763 | 513647 |
| 349716 | 182653 | 286415 | 164985 | 768914 |
| 714932 | 427163 | 825749 | 983567 | 682917 |
| 649752 | 587436 | 268794 | 179428 | 145389 |
| 462758 | 843216 | 853624 | 985273 | 672841 |
| 981374 | 529817 | 862934 | 875126 | 319546 |
| 941258 | 639187 | 871596 | 294378 | 237465 |
| 346521 | 196235 | 762491 | 957641 | 495867 |
| 853926 | 138962 | 435781 | 297568 | |



Solution to test in Fig. 1, page 45: How the blocks fit in the arrow. The answer to Fig. 2 is to remove the three matches within the largest triangle, leaving two triangles

How rapidly do you learn? Below is a simple code, in which each letter of the alphabet is represented by a number. The word "and" would be written 2-13-10. In this test you are to write the code number for each letter just above it, as fast as you can while some one times you. A college student can translate 90 letters into numbers in five minutes.

CODE

| q | a | y | p | z | u | r | s |
|---|---|---|---|---|---|---|---|
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |

| j | d | l | g | n | h | w | o | x |
|---|---|---|---|---|---|---|---|---|
| 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 |

| t | m | b | k | i | f | o | b | c |
|---|---|---|---|---|---|---|---|---|
| 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 |

Translate these letters into their corresponding numbers:

L a t h o t t s r o s c i

f o g a t h o s d a n g s

o n i t h t a h t o h a d

h h e d a r n i h t o a n

f o t e r o n o n w c e m a c

g r n i o w d o p n u s h

i r n e o c o i l e l c t h

e t n i w o g h r t g a r

d k e r h e t s t

a r s s d e m e o c o t s

n i k d r e p e c n i h t

o s y k d a n d i g r w n

If you can pass these tests, you have mental capacity to spare for most of life's activities.

Remember, too, that those who make the most of their ability are the hardest workers. So work hard with your abilities if you would be successful.

Ⓢ This seal on a radio or tool advertisement signifies the approval of the INSTITUTE OF STANDARDS. See page 33.

## Your Dials—Keys to the Air

(*Continued from page 84*)

Practically all of them, however, operate on a loop aerial, consequently it is necessary to follow the instructions for placing the loop that I outlined under reflex sets. This should be done before hunting for the station.

The majority of super-heterodyne receivers have two large tuning dials on the panel. There are some trick "supers," but since they are invariably constructed by men who have a full knowledge of the theory and practice of radio, it is unnecessary to describe their operation here. They are the exception and do not come into general use. On the standard sets the first dial is for tuning to the wave length of the station desired. The second dial controls the frequency-changing device that enables the system to operate with full amplification.

IN TUNING a "super" it is important to move the dials very slowly, otherwise it is quite possible to pass over the proper settings. In fact, a Vernier adjustment, or a geared dial is practically necessary. It will be found that after a station is brought in and the first dial is left in its position, the second dial can be moved around until it brings in the same station at another position. Each of these two positions should be noted, and the one that gives best results used.

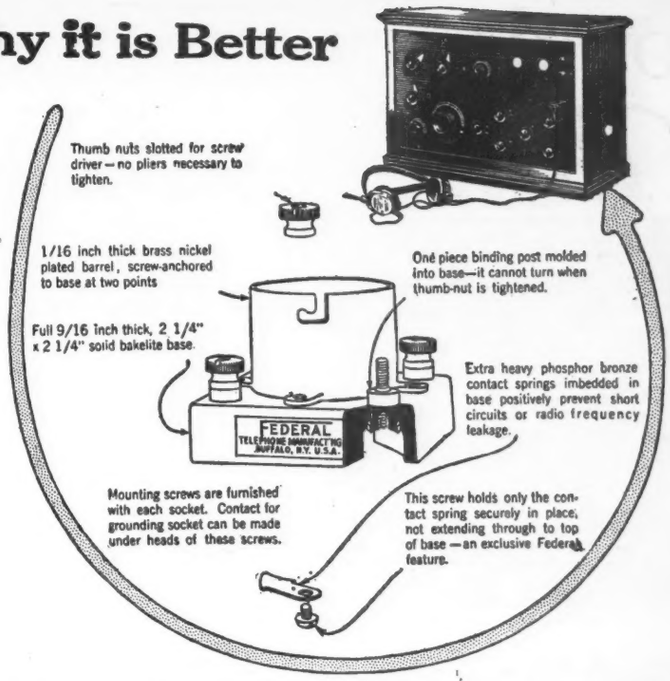
On the second harmonic super-heterodyne there are three, and in some cases four, points where the same station can be tuned in. It is best to log these settings on a card, and try them when looking for the same station again in the future. If interference is experienced at any of the settings on the second dial, go to one of the other points where the station can be heard, and see if the interference still exists. When noise is experienced while listening to a distant station, try reducing the rheostat dials.

After you get a station with the super-heterodyne or reflex set, make a final slight adjustment in the position of the loop aerial. It will be found sometimes that although the loop is pointed directly toward the transmitting station, maximum signals are not obtained. The reason may be a local one. Some mass of metal may be reflecting or refracting the waves, and thus cause a slight variation in the position of the loop. These little knacks of tuning can be mastered after a few days' operation of your set.

## Science of Cross-Words

IF THE cross-word-puzzle bug has bitten you, don't miss the March issue of POPULAR SCIENCE MONTHLY. You will find a fascinating story of the fad that has swept the entire country with such sensational popularity, and—an entirely new kind of puzzle to intrigue your interest.


# Why it is Better


Thumb nuts slotted for screw driver—no pliers necessary to tighten.
1/16 inch thick brass nickel plated barrel, screw-anchored to base at two points
One piece binding post molded into base—it cannot turn when thumb-nut is tightened.
Full 9/16 inch thick, 2 1/4" x 2 1/4" solid bakelite base.
Extra heavy phosphor bronze contact springs imbedded in base positively prevent short circuits or radio frequency leakage.
FEDERAL TELEPHONE MANUFACTG BUFFALO, N.Y. U.S.A.
Mounting screws are furnished with each socket. Contact for grounding socket can be made under heads of these screws.
This screw holds only the contact spring securely in place, not extending through to top of base—an exclusive Federal feature.

**THE picture tells the story—seven practical, sensible reasons why Federal sockets should be in your "pet" hook-up. Federal sockets are but another evidence of the care and engineering skill used in designing and making Federal Standard Radio Parts.**

**There are over 130 standard parts bearing the Federal iron-clad performance guarantee—their use means—"Balanced Circuits" with better performance.**

FEDERAL TELEPHONE AND TELEGRAPH CO.
Buffalo, N. Y.

Boston
New York
Philadelphia
Pittsburgh

# Federal
Standard RADIO Products

Chicago
San Francisco
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Canada

## THE CROWN FUEL SAVER
AND SMOKE CONSUMER

*Not an oil burner but a scientific method of burning coal and coke*

20% COAL-SAVING GUARANTEED

This inexpensive coal-saver and heat producer is a positively safe investment paying extraordinary dividends in *money* and comfort.

**Why pay out any *more* than you have to for coal?**

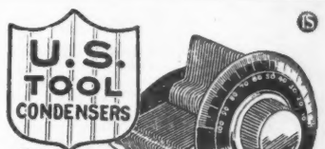
By simply attaching the **Crown** Fuel Saver to your heating plant you can burn lower quality coal, get more heat and a *guaranteed* fuel saving of at least 20% or your money back on demand. The **Crown** offers *more* heat, quicker heat, steadier heat, less firing, less ashes, less expense.

The **Crown** fits the feed door of any heating plant—steam, hot water, or warm air. Furnishes by natural draft pre-heated air to burn smoke and gases usually wasted. (See illustration.) Works automatically. Nothing to get out of order. Lasts a lifetime. Install it yourself. In successful use 10 years in homes, apartments, stores and greenhouses. Write for full information.

**Crown Fuel Saver Co., 12 N. 10th St., Richmond, Ind.**

**DISTRIBUTORS WANTED. Write for our profitable business building plan.**

U.S. TOOL CONDENSERS
TRADE MARK



*A Unique U. S. Tool Feature*

**One Piece Stator**
**(Pat. Applied for)**

Found in no other make, the one piece stator makes the U. S. Tool Condenser 100% efficient. Eliminates leakage, resistance, broken contacts and soldered joints. In types 3 (plain) and 4 (all-vernier) **Celoron End Plates;** types 5 (plain) and 6 (all-vernier), **Metal End Plates;** types featuring the Hexagon Shaft.

*CS and CV low price types always in stock.*

*ASK YOUR DEALER!*

**100% GUARANTEED**

*Write for Literature*

**U. S. TOOL COMPANY, INC.**
**127 Mechanic St., Newark, N. J.**

*Mfrs. of Special Tools, Dies, Jigs, Automatic Machinery and Sub Presses.*

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# Popularity *Plus!*

**Yours-with this most winning of all musical Instruments**

**You can be popular - you can be in demand socially - you can be welcome everywhere - with an irresistible**

**BUESCHER True Tone Saxophone**

Don't be a wall-flower. Don't be a dawdler. Step out of the crowd and into the picture. Be able to *do* something to earn your welcome. Learn to play a Buescher Saxophone.

***Easy to Play***
***Easy to Pay***

You'll be astonished how quick you master this beautiful instrument. It's not necessary to be talented - to be musically inclined. The Buescher Saxophone is so perfected and simplified that practically anyone can learn to play. The scale can be mastered in an hour; in a few weeks you will be playing popular airs. Practice is pleasure, because you learn so quickly. 6 days trial and easy payments.

***Free***

*Send coupon or postal for a free copy of our latest Saxophone Book. Tells all about the various Buescher Saxophones, with pictures of the famous professionals and orchestras. Mention any other instrument in which you may be interested.* 167

**BUESCHER BAND INSTRUMENT CO.**
*Everything in Band and Orchestra Instruments*
428 Buescher Block Elkhart, Ind.

Buescher Band Instrument Co.
428 Buescher Block, Elkhart, Ind.
Gentlemen:
I am interested in the instrument checked below:
Saxophone...Cornet...Trombone...Trumpet...
(Mention any other instrument interested in)
Name .....
Street Address.....
Town.....State .....


## To Do Good Soldering

(*Continued from page 85*)

solder on the end of the copper touches the joint.

Hold it in this position until the solder flows into the joint and over the ends of the wires, as shown in Fig. 3. Then remove the copper and hold the wires steady until the solder has cooled and hardened. Many beginners experience trouble through failure to hold the wires steady. The slightest motion at the instant when the solder hardens will result in a weak joint.

IF THE copper is too cold, the solder will not flow over the joint and the wire ends, and if it leaves the copper at all, it will form in little gobs or drops that often can be rubbed off the wire with the fingers. The whole secret of soldering is to get the solder to flow on the wires like oil on a steel surface and *not* like drops of mercury on a glass plate.

In Fig. 4 are shown a number of soldered joints. At the left is an example of how *not* to do it. Note how the solder has failed to run on the surface of the metal. The second example is the joint that was actually made while the photographs used in Figs. 2 and 3 were being taken. The third and fourth show how the wires should be overlapped if there is to be any strain on them.

After you have the hang of it, you will find that it takes much less time to wire a receiving set by soldering all the connections than it does if you have to carefully form a loop at each end of every wire to clamp under the binding posts of the instruments. Also, it is easier to cut and bend the wires to the exact length when you do not have to allow for the bending of the loops.

If you use the rosin core solder, you need not worry about the excess soldering flux, since rosin is a good insulator itself and has no tendency to creep over the surface and collect dust.

When the greasy types of soldering pastes are used, it is well to use as little paste as possible and wipe off the joint carefully with a rag after each joint while the wires are still hot. If this is done, there is no choice in electrical efficiency between rosin and the usual pastes except in soldering the standard types of jacks that use fiber strips between the contact fingers.

IT SEEMS to be almost impossible to solder these jacks with ordinary soldering paste without having some of the paste run up the lugs and soak into the fiber. This makes a messy looking job and in many cases actually causes leakage losses.

Do not be afraid to tackle soldering. Ten minutes' practice will teach you the knack of it and after that you will wonder why you thought it was so hard!

---

**HOW to build a two-tube radio set that will produce plenty of loud-speaker volume without distortion will be described in an article next month—**

**This is a truly remarkable radio set, nevertheless one that you will find very easy to construct.**

**Real Radio Reception**

**Cunningham RADIO TUBES**

place the skill, experience and resources of the great General Electric Laboratories in every socket of your receiving set.

Since 1915—Standard for all Sets types C-301A, C-299, C-300, C-11, C-12. In the Orange and Blue Carton. Price $4.00 each.

**Patent Notice:** *Cunningham tubes are covered by patents dated 2-18-08, 2-18-12, 12-30-13, 10-23-17, 10-23-17, and others issued and pending.*

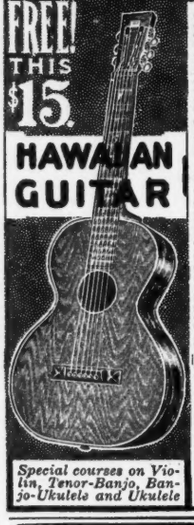
Cunningham 40-page data book fully explaining care and operation of Radio Tubes now available by sending 10c in stamps to San Francisco Office.

C. J. Cunningham Inc.

HOME OFFICE
SAN FRANCISCO CHICAGO NEW YORK

**YOU TOO CAN PLAY THE HAWAIIAN GUITAR**
*JUST AS THE HAWAIIANS DO*
**PLAY ALL THE LATEST HITS**

**FREE! THIS $15. HAWAIIAN GUITAR**



**ONLY 4 MOTIONS** used in playing the fascinating Hawaiian Guitar. Our native Hawaiian instructors teach you to master them quickly. Pictures show how. Everything explained clearly.

**PLAY IN HALF HOUR** After you get the 4 easy motions, you can play harmonious chords with very little practice. 40,000 students have learned to play in this easy, pleasant way.

**EASY LESSONS** The 52 printed lessons with a great many pictures make it easy to learn quickly. You don't have to know how to read notes. No previous musical knowledge necessary. You learn to play any kind of music, and pay as you play.

**FREE GUITAR** As a special offer to new students we give this full size, high grade instrument free of charge. It is sent at once without red tape or delay.

**WRITE AT ONCE** Send your name at once and let us tell you all about the 52 easy lessons and the free guitar. You have everything to gain. Don't put it off. A post card will do. Ask for new special offer and easy terms.

*Special courses on Violin, Tenor-Banjo, Banjo-Ukulele and Ukulele*

**First Hawaiian Conservatory of Music, Inc.**
233 Broadway (Woolworth Bldg.), Dept. 46, New York, N. Y.

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PROMPTNESS ASSURED
HIGHEST REFERENCES
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Send drawing or model for examination and report as to patentability

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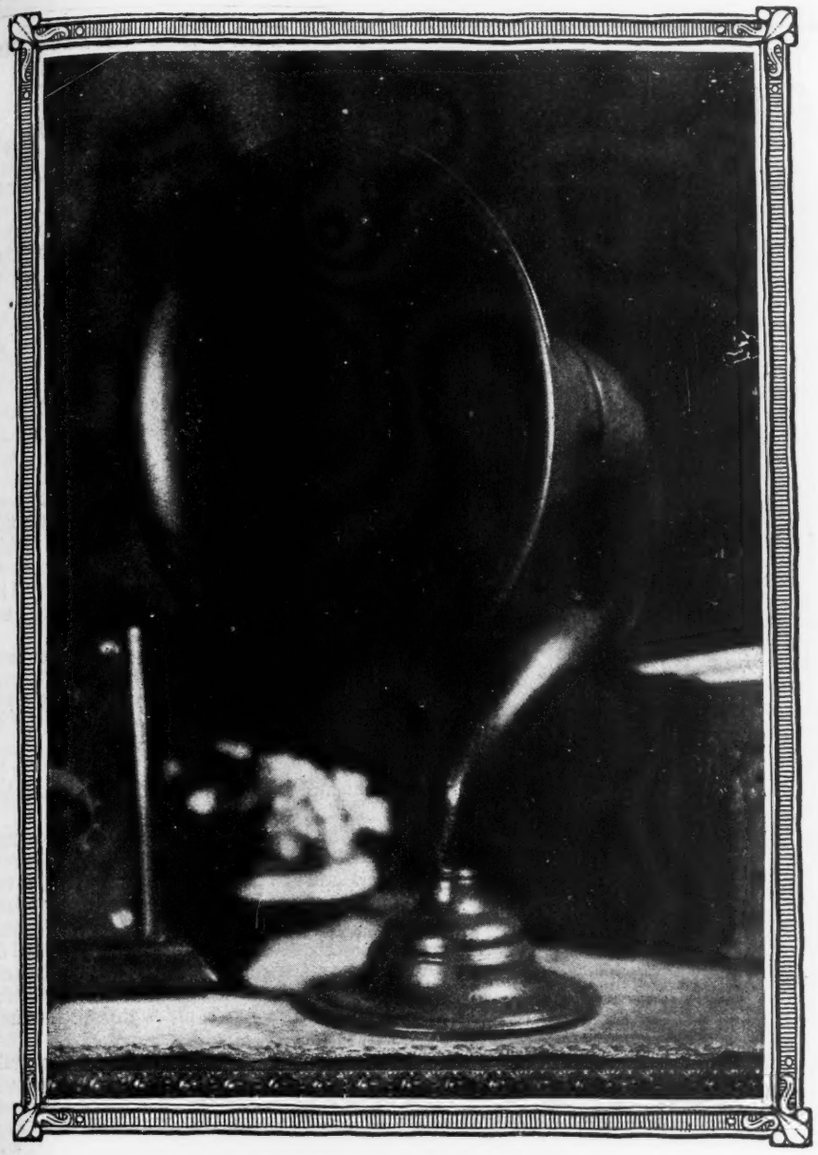

The UTAH
Trade Mark Registered
Made in Salt Lake City

$25.00

Phono-Speaker $10.00

**GUARANTEE**

Buy a UTAH and use it for two weeks. Compare its tone with the best others are able to produce. If the UTAH does not give at least 50% better reception, return it to your dealer and he will cheerfully refund your money.

# NOW! Radio Music as You Never Heard it Before

YOU never heard such tone! You cannot guess the wonderful musical possibilities of radio reception until you hear UTAH reproduction.

Rich, mellow, natural tones of instrumental music—the delicate shadings of the human voice—satisfactory volume from a weak and distant station—or big volume from a strong station, without the rasping and blasting that big volume has always caused—that's UTAH reproduction!

The new UTAH speaker is the latest triumph of acoustical and electrical engineering—the result of two years work by the leading experts in sound reproduction.

## Hear It!

Go at once to your dealer's store and ask for a demonstration. Or better yet, take a UTAH home with you and enjoy it for two weeks under our unprecedented guarantee.

**UTAH Radio Products Co., 1427 Michigan Ave., Chicago**

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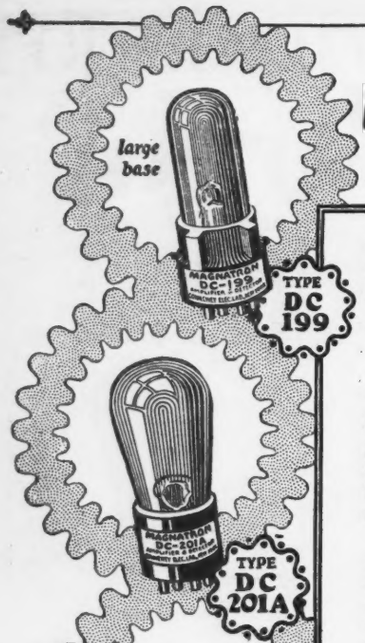



# MAGNATRONS

MAGNATRONS today are better tubes than they ever were before—and that is saying a great deal. MAGNATRONS occupy a front rank position among vacuum tubes; they know no superiors and very, very few equals.

MAGNATRONS have been changed both internally and externally. All types are now manufactured in the tipless form. This is an important feature; it greatly reduces the chances of accidental breakage. The bases, too, have been improved. Pure bakelite is used, thereby cutting down leakage and capacity.

The internal changes in MAGNATRONS make these tubes more fitted than ever for efficient radio frequency amplification and powerful audio frequency amplification without distortion. Convince yourself on this point by hooking a MAGNATRON into the circuit.

MAGNATRONS are made in three types—the DC-201A, the DC-199 with the miniature base, and the DC-199 with the large standard base.

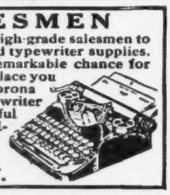
ANY TYPE $4

CONNEWEY ELECTRIC LABORATORIES
309 Fifth Avenue NEW YORK CITY



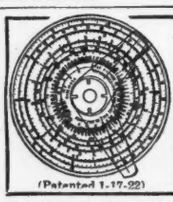
## CITY SALESMEN

WE have a few openings for high-grade salesmen to sell Corona Typewriters and typewriter supplies. No traveling—steady work, remarkable chance for advancement. We can probably place you in your own town. The new Corona Four, just out, is the greatest typewriter value ever offered. A wonderful chance for the right man. Experience unnecessary. Write today.



Corona Typewriter Co., Inc.
Dept. D. S. Groton, N.Y.





(Patented 1-17-22)

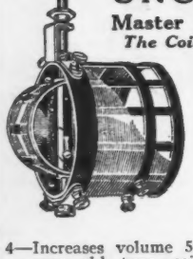
The Midget "Five-in-One" Slide Rule is a combination Mannheim, Polymetric, Log-Log, Binary, Add and Subtract Slide Rule. It will instantly add, subtract, multiply and divide any combination of whole numbers, fractions, mixed numbers and decimals. Gives every root and power, also Logs, Sines and Tangents. Made of aluminum with scales on white celluloid. Size 6 in. Approved and adopted by colleges. Price with Instructions, $1.50. Leather Case 50c extra. Sent C.O.D. if desired. Catalogue Free. GILSON SLIDE RULE CO., Niles, Mich.



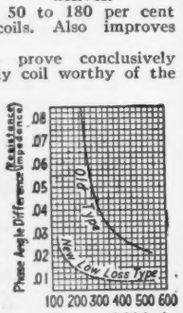
IT'S A WONDER!

The New UNCLE SAM Master Tuning COIL

The Coil Without Losses



1—U. S. Bureau of Standards forms of latticed hard rubber.
2— Perfect spacing of each turn because of new type American Ambassador Litz.
3—Eliminates adhesives.
4—Increases volume 50 to 180 per cent over old type coils. Also improves selectivity.
5—Laboratory tests prove conclusively that it is the only coil worthy of the name low loss.
6—WARNING—Use Ambassador Condensers and Transformers designed and manufactured by Ambassador Engineers for best results with the Ambassador Coil.

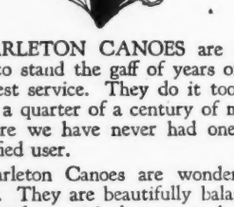



FREE! *Ask your dealer or send self-addressed stamped envelope for wiring diagrams of circuits in which this remarkable coil can be used.*

UNCLE SAM ELECTRIC CO.
209 East Sixth St., Plainfield, N. J.



## Tried by a thousand trails



CARLETON CANOES are built to stand the gaff of years of the hardest service. They do it too. In over a quarter of a century of manufacture we have never had one dissatisfied user.

Carleton Canoes are wonderfully light. They are beautifully balanced, fast and surprisingly easy to handle. And Carleton Canoes are unusually reasonable in price.

Send for our new illustrated catalog. It gives prices and complete information. Write for your free copy today. THE CARLETON CANOE CO., 72 First Street, Old Town, Maine, U. S. A.

CARLETON CANOES


## Four-Tube Set to Fit Your Phonograph Cabinet

(*Continued from page 87*)

screws. Next, mark each hole deeply with a prick punch and drill the holes of a size to fit the shafts or screws that are to go through them. When the holes are drilled, wash off the paper and try mounting each instrument to make sure that the holes are correct. Take particular care to have the holes for the jacks *P*1, *P*2, and *Q* in exact line horizontally, for the sub-panel *T* is fastened to them by means of No. 8-32 brass screws.

THE simplest way to fit the sub-panel *T* is to drill the holes and tap them in the frames of the jacks first, then bolt the jacks to the panel, lay a piece of paper on the bottom of them, and mark where the holes come. You then can use this paper as a templet to show where to drill the holes in the sub-panel. The screw holes in the frames of the jacks should be about one inch from the ends that are fastened against panel *S*.

Next, bolt the sub-panel *T* on and arrange the amplifier sockets, *J*2, *J*3 and *J*4, the audio transformer *I* and the by-pass condenser *G*, as shown in Figs. 4, 7, and 8. No layout can be given for these instruments because of the variation in size and location of mounting screw holes, binding posts, etc.

The sockets should be placed near enough so that the coupling condensers *H*1 and *H*2 can be soldered directly to the plate and grid binding posts. The sockets should be placed so that the filament binding posts are farthest from panel *S*. Now mark off on the sub-panel *T* the locations of the holes for the screws to hold the instruments in place and for the binding posts Nos. 1 to 7.

In addition, there should be a small hole for the connecting wire near each socket filament binding post; one each under rheostats *K*2, *K*3, and *K*4; one for the wire to switch *R*1; one under the plus *B* terminal of transformer *I*; one midway between the solder lugs of jacks *P*1 and *P*2; and two near by-pass condenser *G*.

The fitting of the detector-tube socket panel *U* comes next. It is held in place by a No. 8-32 brass screw that clamps it to the two brass angle brackets. These are held against the panel *S* under rheostat *K*1, and switch *R*2 is set so that the ends come together. The socket *J*1 is fastened to the sub-panel *U* by brass screws with the grid and plate terminals toward tuning unit *A*, *B*, and *C*.

Now assemble all the instruments as shown in the illustrations. This completes the construction work.

### HOW TO DO THE WIRING

It is well to do all the filament and A and B battery wiring first to cut down the chances of an error that might result in burning out the tubes.

From binding post No. 2 run a wire under the sub-panel to the hole under switch *R*1, up through the hole to one terminal of the switch *R*1. Cover this wire with spaghetti below the sub-panel and above it past rheostat *K*2 (see Figs. 2 and 8). Now connect the terminals of

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## Four-Tube Set to Fit Your Phonograph Cabinet

(*Continued from page 162*)

the switches *R*1, *R*2, and *R*3 as shown in Figs. 2 and 4. From the wire between switches *R*1 and *R*2 run branches to rheostats *K*1 and *K*2 and to the minus filament terminal of transformer *I*. Now connect a branch from the wire between switches *R*2 and *R*3 to rheostat *K*3. Next, connect the remaining terminal of switch *R*3 to rheostat *K*4.

The other terminal of rheostat *K*1 should be connected with the nearest left-hand terminal of socket *J*1 (as seen from the rear in Fig. 4). Now connect the remaining terminals of rheostats *K*2, *K*3, and *K*4 with the nearest right-hand terminals (as seen from the rear in Fig. 4) of sockets *J*2, *J*3, and *J*4 respectively, covering the portion of the wire that is under the sub-panel *U* with spaghetti tubing.

From binding post No. 4 run a spaghetti-covered wire under the sub-panel to the remaining filament terminal of socket *J*2 and run spaghetti-covered branches to the remaining filament terminals of sockets *J*1, *J*3, and *J*4, to the terminal nearest panel *S* on by-pass condenser *G*, and to binding post No. 5. Do not worry about the fact that you will be connecting the minus battery terminal of the A battery with the plus terminals of the sockets, and vice versa, because the plus and minus markings on the sockets mean nothing anyway, and on many makes of sockets both terminals are simply marked "*FIL.*"

NEXT, run a spaghetti-covered wire under the sub-panel from binding post No. 6 to the plus B terminal of transformer *I*. Now run a wire across the bottom solder lugs of jacks *P*1 and *P*2 and the top lug of jack *Q*, and from this wire run a spaghetti-covered branch through the hole in the sub-panel to binding post No. 7. The terminals of the jack *Q* are reversed in this fashion in order to keep the polarity of the current through the loudspeaker or phones the same in all three jacks. In the closed-circuit jacks *P*1 and *P*2, the bottom lug contacts with the tip of the plug, while in the open-circuit style of jack (*Q*) the top lug contacts with it.

Now study Fig. 6 carefully and see how the plate resistances *O*1 and *O*2 are held in place by means of wire clips soldered to the center lugs of jacks *P*1 and *P*2. Bend up the wire clips and solder them in place so that the resistances may be sprung into them as shown in Fig. 6. After this is done, you can solder the coupling condensers *H*1 and *H*2 between the plate and grid terminals of sockets *J*2, *J*3, and *J*4 as shown in Fig. 6. Each pair of .006 fixed condensers is placed so that the solder lugs are together. A capacity of .012 instead of the usual .006 is a slight advantage in passing the lowest musical notes.

Next, connect a short piece of wire between the top lug of jack *P*1 and the plate terminal of socket *J*2. Make the same sort of connection between jack *P*2 and socket *J*3, and then connect the lower

(*Continued on page 164*)


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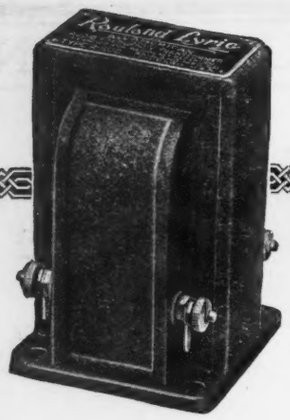


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# A Four-Tube Set to Fit Your Phonograph Cabinet

(*Continued from page 163*)

lug of jack *Q* with the plate terminal of socket *J*4.

Look at Fig. 6 again and see how the grid leaks *M* and *N* are supported by the holes in condensers *H*1 and *H*2 and wire clips branching out from the switch side of the rheostat connections. Bend these two wire clips into shape and solder them in place as shown. After this you can connect the grid terminal of transformer *I* with the grid terminal of socket *J*2, as shown in Figs. 2 and 8.

The tuning circuits have been left until the last to allow more room for work on the lower part of the panel.

Wire the secondary circuit first. Run a wire from the rotary-plate terminal of condenser *D* to the plus filament terminal of socket *J*1 and continue it across to the bottom connection of the secondary coil *B*. Next, run a wire from the stator-plate terminal of condenser *D* to the top terminal of coil *B*. Solder one terminal of grid condenser *E* to this wire and connect the other terminal of condenser *E* with the grid terminal of socket *J*1 with a piece of wire about ½ inch long (see Figs. 2 and 4). This completes the secondary circuit.

THE plate circuit is finished by connecting one terminal of coil *C* with the plate terminal of socket *J*1, and the other with the *P* terminal of transformer *I*. Between this latter wire and the wire from the rotary-plate terminal of condenser *D*, solder by-pass condenser *F* (see Figs. 2, 4, and 8).

The antenna circuit wires are shown clearly in Figs. 4 and 7. The top end of the primary coil *A* is connected directly with binding post No. 1, and the bottom end of the coil is connected with the terminal nearest panel *S* of condenser *G*. Now, connect the remaining terminal of condenser *G* with binding post No. 2, with spaghetti covering on the part of the wire under the panel. This completes the wiring of the receiver.

## HOW TO INSTALL THE RECEIVER

The first step is to remove the wooden partitions in the record compartment of the phonograph cabinet. Then set a wooden strip ⅜ inch thick around the inside of the cabinet about 3 inches inside the door. Fasten this strip with wood screws. A door should be cut in the back of the cabinet, as in Fig. 1, so that the dry-cell B batteries can be placed in it behind the set, and so that tubes can be changed and antenna connections made.

The easiest way to cut the door is to mark it off with a pencil, drill a hole at a corner, and saw down one side with a keyhole saw. Now fit the hinges across the slot and screw them firmly into place. Next, saw down the opposite side and fit the latch or bolt. It is then a simple matter to saw across the top and bottom and you will be sure that the hinges and latch will fit perfectly.

Below the bottom edge of the door drill holes for the antenna and ground connections and the wires to the A battery.

The receiver now can be placed with the panel against the wooden strip and holes drilled near the edges for wood screws to hold it in place.

The storage battery can be kept in the nearest closet, and if care is observed in the wiring of the antenna and ground connections and the wires to the A battery, no one will notice that there is a radio receiver in the room when the phonograph door is shut.

## TO OPERATE THE RECEIVER

After the installation is completed, the necessary connections with the antenna and ground and A and B batteries are made, the rheostats *K*1, *K*2, *K*3, and *K*4 should be turned off, the tubes inserted in the sockets and the switches *R*1, *R*2, and *R*3 pulled out. Then the rheostats shown in Fig. 3 should be turned on slowly, one by one, until the tubes glow dimly. Next, insert the loudspeaker plug in jack *Q* and turn the dial of condenser *D* slowly until a signal is heard. As soon as you hear a local station, turn all the rheostats up slowly until the point of maximum volume is reached. Then place the plug in jack *P*1 or *P*2 and turn the tickler coil dial *C* until the point of maximum volume with perfect clearness is reached. After a little practice you will find the way to turn the tickler dial so as to get maximum regeneration without oscillation or whistling sounds.

Switch *R*1 cuts off all the tubes, while switch *R*2 cuts off the last two tubes, and switch *R*3 cuts out only the last tube. You will note that the arrangement of the switches is such that they control the tubes that are connected with the jacks immediately under them. Thus it is easy to form the habit of pulling out the switch when plug is inserted in the jack.

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*Elements of Electrical Engineering*, by George D. Shepardson, A.M., M.E., Sc.D., professor of electrical engineering, University of Minnesota. The Macmillan Company.

*Handbook of Direct Currents*, by K. C. Graham. One of the "Railwayman's Handbook Series." Simmons-Boardman Publishing Company.

*Meal Planning and Table Service*, by N. Beth Bailey, associate professor, Household Science Department, Iowa State College. A guide for housewives who have no maids. Illustrated. The Manual Arts Press.

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